AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 3, No. 3. WEEKLY. | NEW YORK, JANUARY 17, 1880. | $3.00 per Annum. SINGLE COPIES, 6 CENTS.

How Paper is Made.

Paper is a very ancient fabric, the history of which may be found in most of the encyclopedias, and therefore it does not require repetition. There are eighty and more different substances used in the manufacture of different papers, which embrace almost every conceivable kind of fibrous matter. But the kind of paper which is used for writing purposes and for printing newspapers (the AMERICAN MACHINIST, for instance), requires great care in the selection and handling of the raw material, which is rags, generally. The finest, as well as the strongest, such as bank note paper, is made from linen rags, about one-half of which are imported from European countries, the best, strongest, and cleanest of the foreign rags coming from Austria (Trieste), Italy, Spain and England, while the dirtiest rags are brought from Turkey and Egypt. While on a recent visit to the mills of the Holyoke Paper Co., at Holyoke, Mass., we examined some rags which were brought from Smyrna, the noted ancient Biblical city, and found them extremely filthy, almost falling to pieces when handled. Most of the linen rags collected in this country are from private families, and are generally clean, as Americans generally have sufficient pride to be above being considered filthy, even by rag venders. The paper manufactured by the mills previously mentioned is used principally for writing and envelope purposes. The rags are brought to the mill in covered bales on cars. The cars are run under the elevator or hoist, and the bales are hoisted up to the loft, where the cover is removed and the rags are fed into a "whipper," which consists of a shaft which is set full of sharp pins, and which, revolving with great velocity, will tear up a bale in six minutes. This operation pulls the rags apart, and removes a large portion of the dust and dirt.

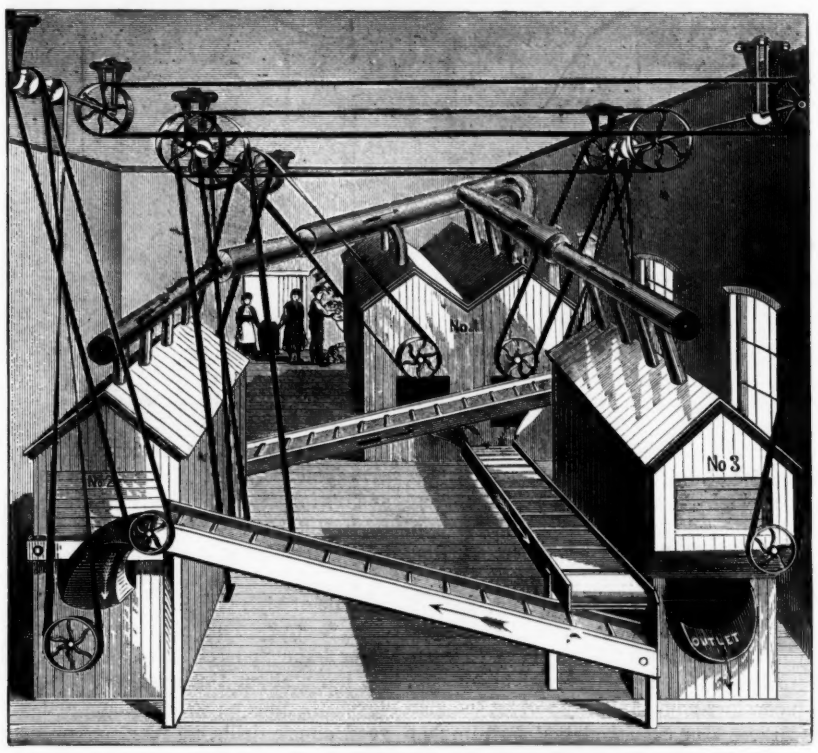


FIG. 2.—RAG DUSTERS IN A PAPER MILL.

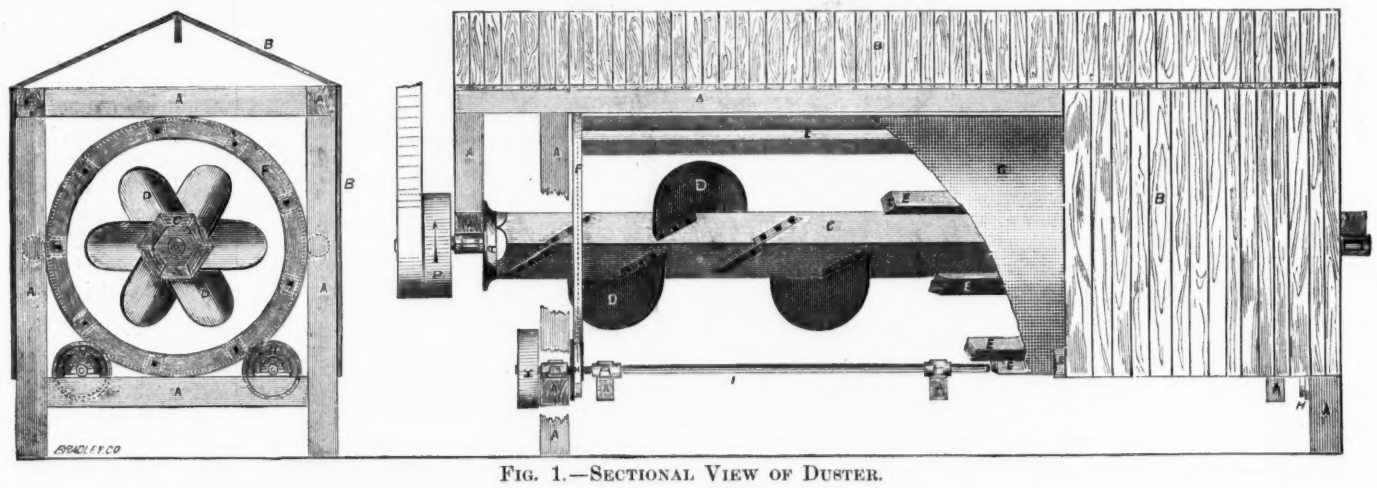


FIG. 1.—SECTIONAL VIEW OF DUSTER.

It is proper to state here, that all of the machines represented by the figures following, with the single exception of Fig. 5, are made by the Holyoke Machine Co., of Holyoke, Mass.

After passing through the whipper, the rags are then put through a machine called a duster, a section of which is shown in Fig. 1, the details of which will be described further on. The rags are next sorted into different qualities for different kinds of paper. About ten per cent of the rags are unfit for use in the best paper, and are sent to other mills, together with the bale covers. Of these the best materials are made into fine manilla, while the worst are used in making roofing paper.

In the sorting room there are about 110 women and girls stationed at benches. A large knife, resembling a heavy scythe in appearance, is attached to each bench, and on seeing such a forest of scythes, one is led to wonder whether there are any more old scythes in the country. The rags, after being sorted, are placed upon these benches, each kind separately, and are then cut into lengths of three to four inches. After cutting, the rags are subjected to a careful inspection, and weighed, by eighteen inspectors, in order to remove any buttons, or anything of a like character, which may have been overlooked in the previous handling. In this way, eight tons of rags are handled daily, in this mill alone. The next process is to put the rags through three dusters connected together, as shown in Fig. 2. The rags are first put into the back end of duster No. 1, as shown. After passing through this machine, the rags come out at the front end, as indicated by the arrows, where they fall upon an apron, which is nothing more than a wide belt running upon pulleys, with sticks fastened across it at intervals.

The rags are carried forward by this device as indicated by the arrow, until they drop upon a second apron, by which they are emptied into the front end of duster No. 2, through which they pass, until, in coming out at the back end of this machine, they fall upon a third apron, which deposits them in the back end of duster No. 3. By this time, there is little or no dust left, for, as it is knocked out in the dusters, it is drawn or sucked away by a fan-blower operating in connection with the pipes, which are shown as attached to the tops of the different machines. Following the direction of the arrow the dust is, by this means, removed so far from the building that there is no possibility of its ever getting back.

The rags then are finally ejected from the outlet in the front of duster No. 3, *clean*, so far as dust and insoluble dirt are concerned.

In some mills the rags are run through cutting machines, driven by belts, which cut them into small pieces, before going into the dusters.

From the sectional view of a duster shown in Fig. 1, it will be noticed that there are no gears used in its construction; consequently it is noiseless. It consists principally of a shaft, with a wooden covering *C*, held in place by the iron collars *R*, to which are attached a number of blades *D*, *D*, the whole of which are driven rapidly by the belt attached at *P*, beating the rags, and at the same time propelling them forward. The whole device acts in concert with the large screen *F*, which, resting upon the rollers *H*, *H*, is driven in the opposite direction by motion communicated through the pulley *K*, and shaft *I*. To the inside of the screen are attached pieces of wood *E*, which extend throughout its whole length, and as the screen revolves, the rags are taken up and dropped upon the top of the shaft, this operation being repeated until they are finally delivered at the end of the machine. The section of the screen *G* shows perforations through which the air is drawn up by the fan before allude to, as none of the dirt can fall down, because the screen exactly fills up the inside of the casing *B*. A railroad duster, shown in Fig. 3, is much used for the same purpose, and is sometimes called a "devil." We do not know from whence it derives its name, unless it is from the vicious manner in which it performs its daily work. The reader may judge by the appearance of the machine whether this epithet is deserved or not. After dusting, the rags are put through holes in the floor, into what is called a rotary bleacher, of which there are three—one having a capacity of 45,000 pounds and two 60,000 pounds at a single charge. These bleachers are simply cylinders, about six feet in diameter and twenty feet long, having two manholes, through which to put in and dump out the rags. They have hollow bearings to which pipes are connected, and through which steam is admitted. A worm and wheel are attached to one end, by which they are made to revolve at the rate of one revolution per minute.

It is now that *cleanliness*, the most essential quality in paper making, asserts its rights. An old adage says that "cleanliness is next to godliness," but, in paper making, cleanliness is considered first, for nothing will restore a lot of pulp after a little dirt has worked its way into it. If a little piece of wood, broom-corn, or anything insoluble has been allowed to remain in the rags, it will now remain in, and will be ground into millions of pieces, spoiling the appearance of the whole product. When the proper quantity of rags has been placed in the bleacher, lime water (caustic is sometimes used) which has been previously mixed and strained, is also placed in with the rags. The holes in the bleacher are now stopped by man-hole plates, and steam is turned on. The steam is kept at a pressure of 50 to 60 lbs. per

square inch. The bleaching machine is then started, and kept rotating from ten to twelve hours, according to the quality of paper intended to be made. In some cases, rags have to be bleached twenty-four hours for the finest quality of paper. When the bleaching process is ended, the bleacher is stopped and a waste-pipe is attached to a cock, through which all the water is blown out. The man-hole plates are then taken off, and the rags are dumped into cars or boxes mounted on wheels. Each of these boxes holds just an "engine-full," or the quantity which is put into the rag engine shown in Fig. 4. The rag engine is an oval-shaped tub from 12 to 24 feet in length, 5 to 8 feet in breadth, and 2½ to 3 feet in height, according to the size of the mill. A short partition called a midfeather is placed in the center of the tub lengthwise, leaving the openings between the ends of the midfeather and the ends of the tub about equal to the distance between the partition and the sides. A shaft *B*, runs across the tub, connecting with a pulley, by which power is communicated to it, a cylinder *A*, being located near the other end.

This cylinder is made of cast iron, having fly-bars or knives of steel, shown in the cut, running across the face, and runs at a speed of about 110 revolutions per minute. These cylinders were formerly made of wood, but now are made of iron with wood placed between the fly-bars, thereby making a much more substantial machine. On the bottom of the tub, and directly under the cylinder, is a bed-plate, to which are attached other knives similar to and set at an angle with those of the cylinder. The fly-bars upon the roll, by their projection beyond the wood placed between them, form buckets, which draw the rags between them and subject them to a violent rubbing and grinding operation upon the bottom knives. The rags are carried under the cylinder from the side *A*, and, after passing between the knives, are dropped upon an incline on the opposite side of the cylinder, which is built up from the bottom of the tub at an angle of about 45°. This incline is called the "back-fall." The rags thus displaced cause the mass in front of them to pass around the tub continuously until they are sufficiently washed and partly pulped. The bottom knives can be adjusted to or from the cylinder by turning the wheel *F*. These knives usually have a cavity on either side of them, which is called a sand-trap, for it is intended to catch any grit which may have dropped in, and to prevent the same from being carried over the knives. In order to purify the rags and pulp still further, a constant supply of filtered water, which is strained six times before entering the machine, is furnished through the valve D. It is necessary to have the cleanest and purest water possible; about 1,500 gallons per minute are required for this purpose. The water used by the Holyoke Paper Co., is taken from several artesian wells and one common well. A "cylinder washer" C, which is usually made with eight sides, is covered with fine wire netting, and is driven from the main shaft B.

The shaft upon which it revolves is hollow, the inside being fitted with wings or buckets, which take up the surplus or impure water, as it is strained through the netting, and discharge it through the hollow shaft into a sewer, thus changing the water rapidly and continuously. This cylinder may be raised entirely out of the way, by means of the handle E, attached to suitable mechanism.

About six hours time is required to wash an "engine-full" of rags, and, as the washing progresses, the bottom knives are gradually raised, thereby reducing the space between them, in order that the rags may be gradually reduced to a pulp. There are eight washing and twelve beating machines used in the mill whose arrangements we are describing. The beaters differ from the engine, only by having more knives in the cylinders, and by running faster. In some mills the engine is made to do the work of both machines; better paper is produced by using both. The speed of the beating machine in this mill is about 125 revolutions per minute.

(To be concluded next week.)

Extracts from Chordal's Letters.

Mr. Editor:

* * * * I really believe that a machinist who likes to see things can find more solid enjoyment in some of the rough-and-tumble jobbing shops located in the woods than he can in some high-toned manufacturing establishment, gotten up without regard to cost. The workmen turned out by such

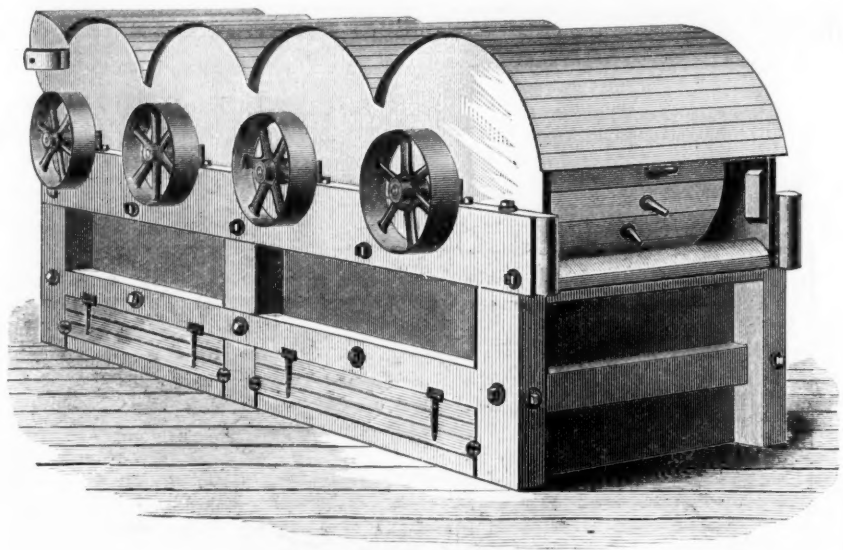


FIG. 3.—RAILROAD DUSTER.

concerns are invariably of more value than those raised in nice shops.

* * * * A new man comes along and says he worked ten years in Hotchkiss' shop. Now, Hotchkiss has the reputation of selling the nicest shafting known to the market. You want a man to turn shafting, and, of course, you ask this new comer if he worked on shafting any in Hotchkiss' shop. He answers truly that he never did much else. You consider yourself lucky and set the man to work. You soon find that he turns the worst shafting in the world and gets out about twelve feet a day. You go for the gentleman and ask him why he can't do some decent work and some reasonable quantity of it. He explains, in a very condescending manner, that if you want good work you must furnish good facilities. He explains that, when at Hotchkiss', he used a special lathe with a wonderful carriage arrangement, carrying numerous tools, and with a centering and straightening attachment, and a burring rest for finishing to size. With this rig he turned a hundred and fifty feet of nice shafting in ten hours, and says he can do it every day in the week, if you will bring him the apparatus. Now you know all about this kind of thing. You have been in Hotchkiss' shop and know this man speaks truly. But you ain't in the shafting business, and don't propose to go into the business. You have shafting jobs now and then, and want to do the work fair in quality and reasonable in price. You don't expect to do it as cheap as Hotchkiss does, who makes a specialty of it. You see, at once, that this man, who was all right in Hotchkiss' shop, don't know anything about turning shafting at all. You hunt up a boy in the other end of the shop—a long-legged, long-headed youth, who has spent two years with you learning the *machinist's* trade. He knows how to turn shafting, and you know it. You put him on the long lathe and he gives you forty feet of shafting in ten hours, and it's forty times as good as the machinist (?) from Hotchkiss' shop could turn. If your long-legged boy ever gets a job in Hotchkiss' shop, Hotchkiss will have a rough diamond capable of high polish.

* * * * You give the new man another lathe and set him to boring pulleys. He bores about three miserable holes in a day. He finds no pulley-boring machine, no good chuck drills, no reamers, no nothing. He ridicules the idea of doing work without tools. He never looks at his own deficiencies, but looks at the deficiencies of the shop. He is a nice fellow, but is not smart enough to admire the men all around him, who, every hour in the day, are doing things he can't do at all.

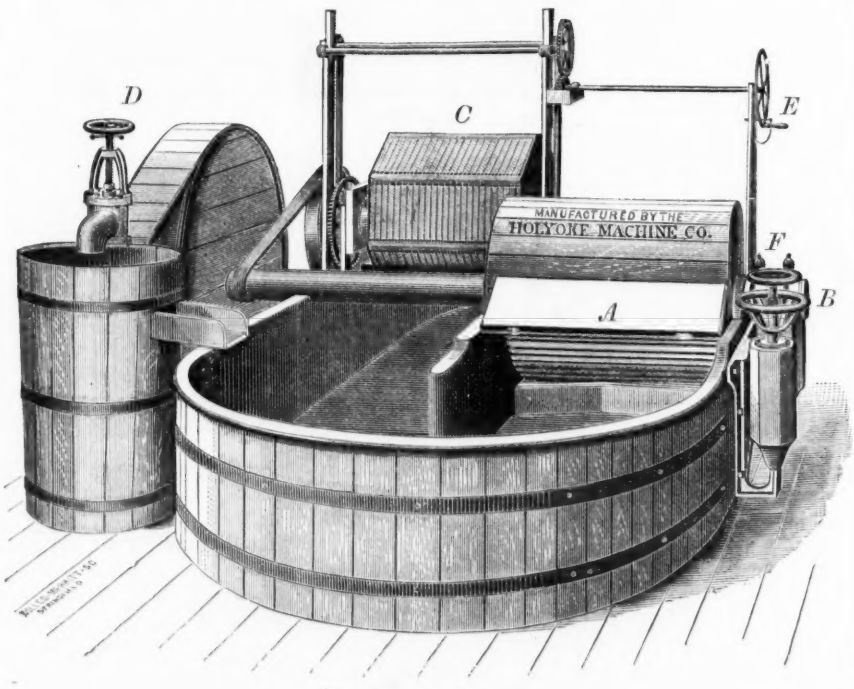


FIG. 4.—RAG ENGINE.

* * * * You tell the new man he is a failure on a lathe. You set him to key-seating some big pulleys. They must be chipped and filed. Does he go and get good solid side chisels dressed, and does he lay a wide straight edge in the hole and draw one mark to chip his key-seat to, and does he sit down on a block and send three heavy, nice, clean, straight, flat cuts through the pulley, and does he file five minutes and show you a nice clean key-seat, out of wind and free from chisel marks, all done in forty minutes? No; he don't. He never cut a key-seat, and never saw one cut this way. He was brought up alongside a slotting machine, and he is now five hundred miles from the nearest slotting machine. He knows he can't do this job, and is smart enough to tell you so. This man is no machinist at all. He served a five years' apprenticeship, and worked on eight years in one of the best shops in the United States, but he is actually of less value than your youngest cub. You put the case to him fairly; tell him you need men and like his looks, and that if he can point out any work in the shop which he can do properly, you will be glad to keep him. He feels badly, and, after looking around, decides that he can't do what the poorest men in the shop are doing. He will do one of two things: If he's a coward, without any coarse grit in him, he will abandon the "machinist" trade and tramp back to Hotchkiss and beg for a job on that shafting lathe. If he has the right stuff in him, he will start in and learn the trade. He has sense and experience and don't need to commence just like a boy. He can start anywhere he chooses, at such wages as his work shows he earns, and increase his wages as he increases his value.

* * * * You go into one of these rough and tumble shops and watch a man at a lathe. He whistles and sings and sky larks and smokes, maybe, and does a hundred other things which the high and mighty think ought to send a man to the penitentiary. But don't that chap do the work though? Don't he earn and get good wages, and don't the proprietor make more off of him every day than the high and mighty do off of three men who were brought up to use every modern facility and who are stumped if one of the aforesaid facilities happens to get broken. Watch this *outre* machinist as he works. He runs an eighteen-inch lathe, perhaps, and the work brought to him might well be, and, in a better fixed shop, would be, distributed among big lathes, little lathes, Fox lathes, planers, slotters, milling machines, cutting machines, drilling machines, screw machines, bolt cutters, gear cutters, etc. But this chap does every thing which is laid by his lathe. Some he does tip-top, some he leaves slouchy, but all of it is done as well as is required. He does this all the time. He lives on it. Every job he does is something he, or anybody else, never did before, but he does it all the same. This man is no mere machine wound up and set to running a shafting turning machine. This shop ain't a manufacturing concern with a system adapted to a special product.

This is one of my Simon Pure machine shops, doing job work, new and old, and this fellow we see is a lordly lathesman, a real machinist. You may set him down in any shop in the world where there's a lathe, and a job to do, and he can do it. He will jump at new and better ways, but is not helpless in the meantime. He's no baby. He's a machinist, and he's worth money every day. Oh, ye puny chaps that claim to be lathesmen! You only know one way of doing things, and that's the way you was *taught* to do it. You only know how to do one job, and that's the job you worked on while you was being taught, and you can't do that job when you get in another shop away from home. Ain't you ashamed to ridicule a poor one-horse machine shop when every man in it is immeasurably your superior? Ain't you ashamed to claim fellowship and equal wages with these sharp fellows, full of mechanical wit, who do work every day which you don't even dare to undertake? You say they can't do it well. You can't do it at all. You don't know how to tackle it. * * * * * * * Look at the job this lathesman gets. He is sitting on a casting and handling a connecting rod strap. It's a rough forging for a strap to hold square boxes. You can't see a bit of lathe-work about it anywhere, or a chance for any. Pretty soon he gets his present job done. Now he puts a miserable-looking angle-plate against his face-plate, and sets this strap in some shape. He fishes a dirty piece of paper out of his tool box. This paper contains a memorandum of sizes which he took down verbatim as the foreman gave them. He goes to work, and in two hours lays two hours of planing on the

floor. He has surfaced that strap nicely and squarely all over the outside. There's one job of "lathework" done. There is but one planer in the shop, and that is too much crowded to be doing anything that can be done in any other machine. That same planer will stand still six months in the year, so it would be folly to get another, and thus be ready for a rush which never comes when you are ready.

* * * * Here goes for the next job. Twelve stubs about two feet long, one-and-three-quarters diameter, to have thread cut eight inches on one end. No turning, simply a thread to be cut. They belong to a bridge-bolt job, and the bolt cutter has no dies for this size. Soon this job is done. It ain't nice lathe work. Nothing to be proud of, but it is o. k. in every way. What next? He puts on a chuck and proceeds to chase out twelve hot-pressed nuts for these bridge bolts. Ough! how your teeth grit to see a lathesman having to do such a job. It's a nasty job, but there's no tap that size, and soon it's done and off this chap's mind.

* * * * * * Next comes some nice lathe work; a couple of valve stems and two or three small wrists. They are finished to the sizes given and nicely polished. He gets them done, and feels proud of them. Bless him, any lathesman can do such work.

* * * * * * Here's a brass casting for a two-inch stop-cock, and by it lies the old one. It's a repair job. The old one is bursted wide open. The plug is swelled, but not broken. Does a foreman come around and instruct this man how to do this job? No, sir. His orders were to "rig up that cock." He takes the casting, chucks it, and in half an hour has a two-inch pipe thread chased in each end. Now he chucks crosswise, and you suddenly notice that this cock must be bored tapering. How is this fellow going to bore this hole? Will he go and get a nice taper reamer? I guess not in this shop. Will he fit up some kind of a reamer? Not he. He is fitting up an old water-cock, not making new reamers. He'll set the head of the lathe over, won't he? No, he won't. Thank God the head of the lathe can't be swiveled. Will he set the Slate taper attachment over? Guess not, seeing as he never heard of Slate; and don't know what a taper attachment is. Will he use the compound rest? He may, some day, when such a thing gets into the shop. Will he stick a wedge under the back wing of the carriage? No. He never heard of it, and is not so deep an inventor as to think of it just when he wants it. Will he wrap a cord around his cross-feed screw-handle and tie it to his tail-stock, and thus get the taper? No, he has no time to invent this ingenious plan. Will he find a fancy little sliding-head boring-bar somewhere? Not a bar. Has he a mandrel which he can screw his chuck on, and thus do the job in the steady rest? No, sir. He won't do any of these smart things, and he won't tell you that the shop ought to have a Fox lathe for such work, and he won't tell you how the Metropolitan Cock Company bore them out, for he don't know, and, I am sorry to add, he don't care. All he cares about is to lay that cock down on the floor and call it done, and as well done as is needed.

He whistles a very peculiar air in a very soft manner and turns his cross-crank slowly to keep time. The result is a hole which is tapering if it's nothing else. It would have taken him just about as long to bore it straight. He takes the job out. Puts on a face-plate, and puts the old cock plug in the lathe. He chalks it and hammers the swells out, or in, rather. Then he sets his lathe over and takes a light cut over it. Then he makes a close fit in the cock, but keeps the plug large. Now he goes to a vise and *files the hole*. It was tapering all right, but the sides were not straight. He files carefully, but boldly, watching the tool-marks in the hole, and trying the plug. Soon he is done with the filing, and returning to his lathe completes the fit of the plug. Now he guides it in, and soon there ain't a file-mark or a tool-mark in the hole or on the plug. It is simply a first-class water-tight taper job, quickly done in a third class manner. He screws the thing together, and bounces the next job. Time on old cock, three hours and a quarter. You or I could do it as well or as quick with all the cock-making appliances in existence. This man never fitted up a water-cock before. He is a machinist, and will hustle out any job you will bring him, and will do it as good as you want it done, and no better. * * *

Very respectfully,

CHORDAL.

Machine Finish.

BY F. G. WOODWARD.

In objects of Art as well as of Nature, the curve must ever be considered as one of the chief elements of beauty. In machine construction and finish there is no form so satisfactory as a smooth, rounded surface, or a beautifully curved section and outline, free from corners, angles or abrupt terminations. Wherever a spherical surface joins a curved surface, or a curved surface a flat surface, or a straight line a curved line, the straight should form an exact tangent to the curve, as shown in the samples. Fig. 1 is a

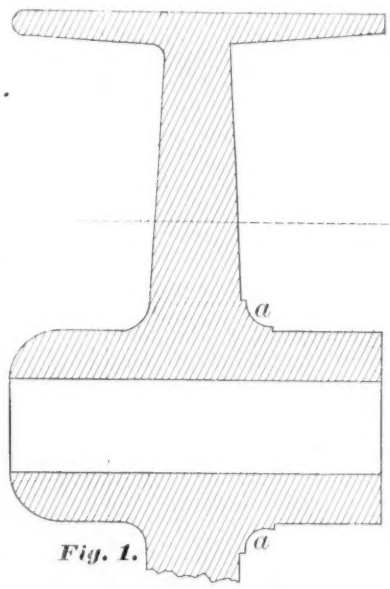


Fig. 1.

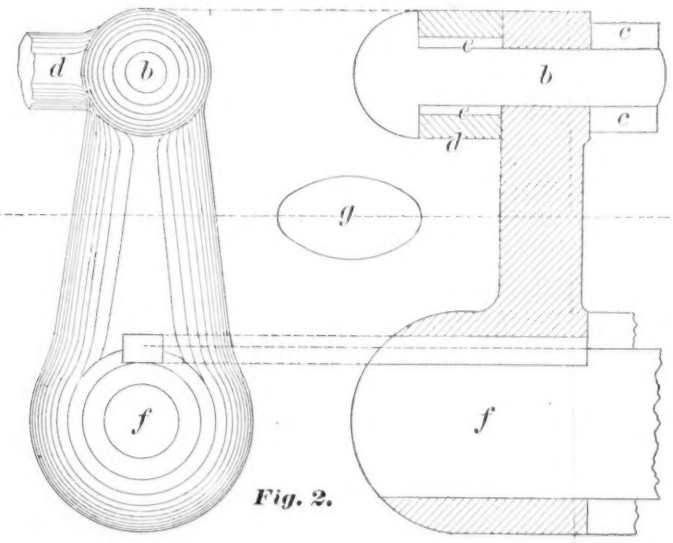


Fig. 2.

partial section of a pulley showing both the angular and the curved styles; and Fig. 2 a plan and section of a rocker-arm of the curved style. The reader will notice that the arms of the pulley should join the hub and rim at an exact quarter turn, and that the inner face of the rim joins the outer face by half a circle; the straight thus forming a tangent to the curve. Machinists are quite apt to interpose an angle at the junction of their straights and curves, as seen at *a*; but we are glad to note that this practice is being gradually discarded in favor of the smooth style. All bolts and nuts used in the finished details of a machine, as shown at *b c*, Fig. 2, should be arranged, so as to expose the head of the bolt, rather than the nut, to the eye; and let the head be finished off flush with the adjacent part (*d*), and in such cases, as here given, it has been my practice to interpose a steel ring (*c*) between the eye of the connecting rod and the bolt, instead of shouldering the bolt, as is usually done, making the ring a trifle longer than the eye of the connection, so as to give an easy fit to the eye, when the head of the bolt is drawn firmly against the ring. These steel rings are easily welded up from flat bars of steel, or they may be cut off from steel tubing.

If the projecting ends of shafts are rounded off flush with the hubs or boxes in which they are fitted (as seen at *f*), and finely polished, it gives a fine contrast with the drab japan of the box or hub. An oval or elliptical cross section (*g*), is the most appropriate for pulley and rocker arms and the like. Castings, malleable, steel and gray iron may now be obtained about as strong and reliable as forgings, so that all of these desirable rounded forms may be so smoothly cast as to need but little done to them except fitting and japaning.

Let the hints above suggested be fully carried out in all of the large and small details of machinery of all kinds, and the vigilant operator will thank his stars that he or she has got a machine at last which can be handled without gloves, and no danger of barking the fingers, and which can be wiped up in ten minutes instead of an hour.

Two-foot Gauge Railroad.

The people of Franklin county, Maine, are rejoicing over the completion and successful operation of the Sandy River Narrow-Gauge Railroad, that has been in course of construction since July last, from Farmington to Phillips, a distance of eighteen miles.

It was completed and trains commenced running on the 20th ult. Its success thus far fully demonstrates the practicability of operating such a road in a locality where business would not pay the running expenses of a broad gauge. The impetus that its completion has given to business by the attraction of capital to that section, will serve to develop the natural resources that have lain dormant just for the want of such an outlet as this road provides. This is believed to be the first and only two-foot gauge railroad in successful operation for the conveyance of passengers and freight in the country. It has been visited by several parties interested in its working. One party from Florida, after examining it in all its details, placed an order for rolling-stock with the builders of this, and intend to have a road of thirty miles completed in that State by the mid-summer of 1880.

A bright future is predicted for this style of narrow gauge. It will serve as a prerequisite for the broad gauge, reaching out and helping to develop the country not yet able to support the latter.

F. H. MORSE.

1176 Tremont street, Boston, Mass.

Steel and Steel Making.

There are two kinds of crucible steel, pot steel and cemented steel. The first, as its name indicates, is carbonized in the pot or crucible, and after being melted is cast into an ingot suited to the work in hand. It is thus made: A quantity of wrought-iron, steel scraps, powdered charcoal and flux are packed in a plumbago crucible, having a cover luted tight, and melted down, the quality of the iron and amount of charcoal and scrap determining the kind of steel made. Spring steel, for instance, being of a high grade of carbonization requires more charcoal than tool-steel; while tool-steel, requiring great toughness, tenacity, and uniformity of quality, is made of a finer kind of iron, generally Swedes or Norway—of a special mark or brand. This is the system employed generally in American steel mills, and it has proven entirely satisfactory, so far as quality and quantity of production are concerned for a given capacity.

The other method of making crucible steel is indirect, as it is not carbonized in the pot, but by the cementation process. This is the oldest method in general use in civilized countries for carbonizing iron. It consists, as most persons know, in subjecting wrought iron bars to a red heat for a certain time, confined in a receptacle and covered in with powdered charcoal, the carbon of which is absorbed, and the nature of the iron changed from fibrous to crystalline. These bars are then taken out and sorted, according to quality, and used as occasion requires. For example,—the steel, when taken from the box in which it is carbonized is full of scabs or blisters, and is known as blistered steel. It is, of course, more or less imperfect. If these bars are cut and welded, it is known then as shear steel; shear steel, cut and re-welded, is known as double shear. To make crucible steel of cemented steel, the blister steel bars are broken up, sorted according to grade, and then melted in pots and cast in ingots; more or less wrought iron being added in the pot to the blister steel, to determine the quality desired to make.

It is easy to see, that by this process, very much more labor and expense are entailed than by the direct method, while it is questionable if any more accuracy of result is attained. Both systems have their advocates as regards fallibility, but being partisans of neither, we shall not discuss the matter here. We may say, however, in regard to the direct process, that it is the one practised by American steel makers (though some cemented steel is made by them also), and as our domestic steels have practically driven the English out of the market, the question seems to answer itself.

As shown in the foregoing paragraphs, these methods of making steel are, necesarily, expensive and slow, and the demands of civilization required less costly and swifter ones. The pressure resulted in the discovery of the product known as Bessemer steel. By this the steel is produced direct from cast iron, without the intermediate process of turning it into wrought iron. Briefly, cast iron, having too much carbon in it for steel-making, must first be deprived of it. This is accomplished by burning it out. To do this it is first melted and then run into large cast iron vessels, lined with fire-brick, known as converters. In these it receives a blast of air, the oxygen of which combines with the excess of carbon and burns with an intense heat and brilliant flame. The iron, therefore, supplies its own fuel for its reduction. When the excess of carbon is consumed, the resulting iron is re-carbonized to the exact amount required, and the steel is made. It is then cast into ingots and is ready to be rolled at once.

This is the article known as Bessemer Steel.

Siemens-Martin steel is also made in large masses, but, instead of using the pneumatic process described above, the charge is made, partially, of wrought iron and steel scrap, and is kept in a state of fusion, on an open hearth, until the carbon is added to the amount required. It is then treated as other steels are, so far as manipulation is concerned. It also can be made in large masses, forty tons being the usual charge, and very uniform in quality; but, although occupying a position midway between crucible and pneumatic steels, and being a formidable rival to the first, it has many peculiarities of nature which are not fully understood, and which prevent it from supplanting crucible steel in any work where cutting edges are required, such as axes and carpenters' tools generally. It is capable of being hardened, but not tempered, and there is a vast difference in these two stages. If Siemens-Martin steel is chilled, and the resulting hardness drawn, as in crucible steel, when a chisel is made, the temper runs right down; the color shown is quite unlike crucible steel, being much duller and altogether different in aspect; while the condition of the cutting edge lacks durability. It seems to be more like case-hardening than tempering.

Practical Draughting.

Paper, the Draught-Board, T Square, and Triangles.

BY T. P. PEMBERTON.

The first thing to be considered in relation to a draughting-board is its size. This is a matter in which students are apt to blunder; they think any convenient size will do, and order boards to be made to dimensions which suit their own fancy. When, however, they place a sheet of drawing-paper on the board, they find considerable discrepancy in size and shape. Sometimes the sheet is too large; sometimes too small. Now, the white paper in sheets purchased from dealers in artists' materials is generally imported, and has certain sizes, thicknesses, and names. The sheets of different sizes are known by the following names:

Cap	13 x 16 inches.
Demy	20 x 15 "
Medium	22 x 17 "
Royal	24 x 19 "
Super Royal	27 x 19 "
Imperial	30 x 21 "
Elephant	28 x 22 "
Columbier	34 x 23 "
Atlas	33 x 26 "
Theorem	34 x 28 "
Double Elephant	40 x 26 "
Antiquarian	52 x 31 "
Emperor	40 x 60 "
Uncle Sam	48 x 120 "

Sheets, such as "Imperial" and "Double Elephant," can be obtained of double thickness, although in the regular grade of drawing paper in sheets, it will be found that the smaller the sheet the thinner the paper, and, on the other hand, the larger the sheet the thicker the paper. Some of these sheets are "hot-pressed," others "cold-pressed." The former bear a fine, smooth, glossy surface, and are suitable for fine line drawings; the latter have a rougher surface, and are more suitable for tinting and shading. The imported paper from England is mostly from J. Whatman's "Turkey Mill." It bears this stamp or water mark, which may be perceived when the sheet is held up to the light.

When this name can be read in the proper direction, or when the letters are right side up, the draughtsman may use that side of the paper as *the* side to draw on. Papers, white, brown, and buff, can be obtained in rolls suitable for large drawings, and are used extensively for the rougher description of shop drawings and architectural details of buildings. For copying drawings there are "tracing paper," and "tracing cloth" or "vellum," as it is sometimes called. The former can be had in sheets or rolls; the latter in rolls. The tracing cloth is extensively used, on account of its durability and strength. It is invariably used in Patent Office business. Tracing *papers*, not cloth, can be had in sheets:

Demy	20 x 15 inches.
Columbier	34 x 23 "
Double Elephant	40 x 26 "

Tracing cloth in rolls can be had of different widths up to 42 inches. Besides the papers mentioned, there are others used for special purposes, as "Muslin-backed Continuous Drawing Paper," "Double-length Profile Paper," Continuous, or Rolled Profile Papers," "Cross Section Papers" &c.

It will be seen that the size of a draughting board should suit the size of drawing paper. Two sizes are very convenient—one to take "Imperial" paper, and the other for Double Elephant. The first should be $32'' \times 23'' \times 1''$ thick, the other $42'' \times 28'' \times 1\frac{1}{4}''$ thick. These sizes allow the use of all sheets less than $40'' \times 26''$. The smaller board is handier for smaller sizes of paper. There are various methods used in the construction of drawing boards, the object being to have them "stand," and made so that they will not warp or crack. The boards must be of well seasoned pine, thick, without knots, and cleated on the back. Hard wood is unsuitable, as it bends the points of the thumb tacks and instruments. The end cross-pieces, so frequently seen on thin drawing boards, without any battens on the back, are objectionable on account of the unequal shrinkage, which causes projecting shoulders at the joints and renders the edges unfit for the T square.

The annexed figures represent good forms of drawing boards. The right construction of such boards is generally obtained by entrusting the work to an experienced pattern maker. The left and bottom edges should be square with each other, and the corners left square or slightly rounded off. Knots, putty and shellac, on the upper or drawing paper surface, should be avoided, especially if the paper is to be mounted or stretched by dampening and fastening it down with mucilage or glue.

Fig. 2 represents the back of one of the best forms of drawing boards now made. It is made of pine wood, glued up to the required width, with the heart side of each piece of wood to the surface. A pair of hard wood battens are screwed to the back, the screws pass through the ledges in oblong slots, bushed with brass, which fits closely under the heads and yet allow the screws to move freely when drawn by the contraction of the board. To give the battens power to resist the tendency of the surface to warp, a series of grooves are sunk in half the thickness of the board over the entire back. These grooves take the transverse strength out of the wood to allow it to be controlled by the battens, leaving, at the same time, the longitudinal strength of the wood nearly unimpaired.

To make the two working edges perfectly smooth, allowing an easy movement with the square, a slip of hard wood is let into the end of the board. The slip is afterwards sawn apart at about every inch to allow for contraction.

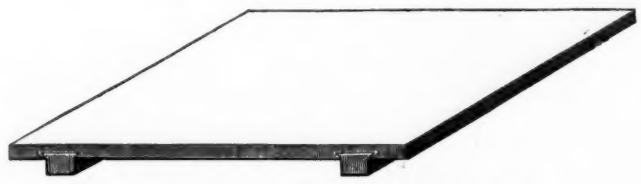


FIG. 1.—PINE BOARD WITH HARD WOOD BATTENS.

FIG. 2.

Address to Student Engineers.

The following is the conclusion of Mr. CHAS. E. EMERY'S admirable address, begun last week. For want of space, we are obliged to omit some portions.

HOW TO SUCCEED.

When a problem can be settled entirely by the consideration of principles, or calculations founded thereon, you can state your case more forcibly. For instance, a rock shaft, with long arms, requires to be surprisingly large; and if your lot is cast in a place where such a detail has not been worked out by theory or the results of practical failure, you may have the opportunity of first showing such a shaft, and be asked derisively if you propose making the rock shaft as large as the main shaft. By a clear statement of the nature of the strains, referring incidentally, perhaps, to Wohler's law in relation to reverse strains your views may be sustained, or, what was at first stated to be an inch too large, be cut down one fourth inch, or something of the kind. You should be very careful not to exhibit either exultation or displeasure, whatever the decision may be.

As your experience increases, your judgment becomes very much better, as it takes into consideration a wider range of facts. You will learn that it is not desirable to construct articles in certain ways easily represented on the drawing board, simply from the difficulty of making the forgings or getting the patterns out of the sand, or finishing with tools. Often, too, the design must be adopted for the use of the particular tools in a particular establishment. Designs must also be adopted to avoid shrinkage cracks in the castings, to avoid difficult cores, to make it possible to leave cheaper green sand cores when the castings are to be duplicated, and to accomplish many, very many practical purposes which possibly you have heard mentioned, but have yet to thoroughly investigate.

It will be a pleasant, inexpensive pastime, and a remarkably instructive one, to take a cup and saucer, with a teaspoon in it, and mould the whole in green sand, so that a perfect casting will be obtained, with the spoon touching the cup in two places only, as is usual. This is one of the old time tests of the ability of young Scotch mechanics, which requires more study and general information than mere mechanical skill.

I may here remark, that it is not necessary that you be skilled workmen in any branch; but you should learn the uses of tools sufficiently to know what is practical and expedient, and make designs, and direct your work accordingly.

* * * * *

Just here an incident will be of interest. It has been claimed that written examinations are unfair for those who have had only the opportunities of a good English education and practical life. I have not so found it. I recollect a written hypothetical question, in which a certain side wheel steamer, with Stevens' cut-off on engine, was running under low steam with wide throttle, when the jingle bell rang violently, and word was shouted to go ahead fast to avoid a collision. To one not familiar with the subject, the engine was already doing the best possible; but many answered the question correctly, and among the replies was one in these words: "*Ship the bar and give it to her.*" Few here can appreciate this answer. The man was pretty well informed, and could have replied in language more elegantly chosen. But evidently the spirit of the impending collision was on him, he felt it was a time for action, and not for words, and any expert feels that he knew how to proceed, and that the necessary steps would be accomplished in a twinkling at the moment of danger. Little do we appreciate how much we depend upon those who actually manage our means of transportation, but our confidence is not misplaced. A volume could be written on the subject, but it is out of place here. I have referred to the matter simply to ask and answer the question, why is it necessary that these young men, and others like them, should actually participate in such work? Simply, that they may know how to design apparatus which shall be reliable in times of danger; which shall not have parts liable to derangement; which, in fact, shall embody all the conditions of the problem. Economy is but one consideration. Many attempts to accomplish it may prove to be poor economy in the end. When one feels that the lives of others are dependent upon his designs and the fidelity of their execution, matters appear in a different light, and it is felt that theory and practice must go hand in hand to attain true scientific success, or that in which all conditions have been duly weighed.

If you become connected with a manufacturing establishment, an important part of your duty will eventually be the preparation of estimates. You should be very ready in resolving the various irregular parts of a design into figures, of which the volumes and corresponding weights of the finished articles can be readily calculated. Apart from this, if prices can be established from books showing the cost of similar work done formerly, estimating is simple arithmetic; but woe to the young gentleman who has been habitually careless in his calculations at school, and in spite of frequent warnings and penalties, excused himself by the thought that they were arithmetical blunders, and that he understood the principles. In making estimates this will not answer. The probable cost must be ascertained, so that a reasonable profit can be added, and work obtained in competition with others, to keep the establishment occupied. A clerical or arithmetical blunder may cause loss in the competition on the one hand, or worse, cause loss of money on the other; and it is not pleasant to have it brought home to one that he is the cause of a loss of a thousand dollars, more or less, according to circumstances. It is a common error to estimate accurately the weight and price of the shell of a boiler, and forget to add the cost of the tubes. Errors also frequently occur in measurements and in drawings, it being most common for one part to be exactly one inch or one foot longer than the part to be applied thereto. The error is so simple and obvious that it is provoking; but one part is an absolute loss just as much as if the blunder was fractional or less simple. You will readily devise general checks to prevent mistakes of this kind. Frequently, however, much judgment and experience are required to fix the price of the work, and it will be of great benefit to you to make a special study of rules for estimating, which will eliminate the errors of judgment.

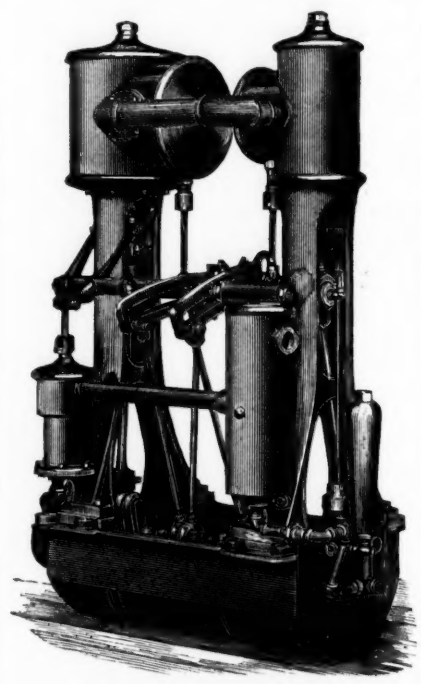
Given the specifications and lines of an iron vessel to find the quantity of material. Every shipbuilder has a simple rule founded on the length, breadth and depth of the vessel, but modified by certain allowances as to the shape and average strength of parts. Such a method is inaccurate for special cases, while it must be acknowledged that a thorough detailed estimate would be tedious. You will study out methods embodying the advantages of both systems.

The weight of steam engines may be expressed in terms of the stroke of piston, the square of the diameter of the cylinder and a constant, in an equation which will be surprisingly accurate for engines entirely similar in design and not varying greatly in size. But other designs, even of the same type, will require a new constant, showing that the rule is not a general one. Any one of you, proposing to identify himself with the manufacture of steam engines, can well afford to make a more elaborate series of rules of general application. To do this, the proportions of the parts should be established as a basis. For instance, the proper thickness of a cylinder is a fraction of the diameter of bore, plus a constant, representing the material required to keep the cylinder in shape, and provide for re-boring, etc. From this, and the length, you have two of the factors of a quantity representing the volume of the cylinder proper, and readily derive the weight. For every detail, similar rules can be made, which will prove true within all the limits of practice. Evidently, the several equations can be combined to give, for any member, its volume, thereby establishing the

weight; its surface, thereby establishing the cost of the pattern work; and the area of certain portions of the surface, thereby establishing the several grades of finished work. The latter, in connection with simple observations to determine the cost in terms of the area, for the differeut operations of boring, turning, planing, scraping, etc., with an allowance for time in handling, would give truly general formula, from which costs could be determined; and the multiplicity of details necessary in the preparation of such formula would be repaid by the fact, that the proportions of all parts could be determined accurately from the original rules at the same time. By collecting proportions of engines of different sizes, and finding general equations adapted to the linear dimensions, those for volumes, etc., follow as a matter of course. Investigations of this kind may well occupy your minds when at leisure, instead of permitting the time to be wasted, and have the practical advantage of being directly in the line of busines, and, therefore, immediately available.

You cannot all expect to find ready employment in the matters you have learned to do well here, for instance, careful tests and experiments; and such occupation, when obtained, will rarely be of long duration. Unfortunately, the majority of manufacturers do not distinguish between scientific experiments, to develop the resources and increase the value of their productions, from experiments with worthless inventions, which have caused a prodigious waste of money and much distress and suffering. The spread of technical education will do something to check such extravagance, but not much. Nearly every man, at some time in his life, believes himself a mechanical genius. Some most distinguished men will interest you, telling of early pet ideas, such as perpetual motion, windmills on boats to drive paddle wheels or screws, or equally important matters. As you grow older, you will be confidentially taken to some back garret by a fond father, to pass upon the improvised mechanism of one of his sons, and counsel as to his natural bent and future career. Of course you will advise that he be sent to *Stevens Institute*. More than this, your own valued friends will bring their ideas to be passed upon by you, and really expect you to put them in practical shape, and give them half of some fabulous expected profits, when, in fact, you will be obliged to say, as kindly and indirectly as you can, that the projects are entirely worthless.

The unfortunate ones, who have the opportunity to exercise their mechanical genius themselves, are generally those least fitted by education to do so—though some of them are excellent scholars in everything but engineering—and improperly reason that their success in one direction, acquired by the slow, sure method, will equally favor them in an abrupt attempt to control mechanism they know little or nothing about. Their money, and that of others, is spent. The first effort is a failure. More money is obtained and goes in the same direction. Failure follows failure, till ruin results to all directly interested and many of their friends. Or, eventually, a new business is established, based on a specialty, developed at such cost that the enterprise can never pay, at least, the original investors. This is a kind of engineering that engineers have little or nothing to do with. If one is called in, his opinions do not satisfy the ideas of the energetic man who is proving his genius, and the ridiculous proceedings go on to the inevitable end. Many enterprises of this kind are carried on by crafty men, who organize a company to press an invention which has some apparent merit, and make a livelihood by inducing the unwary to invest their savings in speculation, which, generally in the end, benefit only the promoters, who manage the company. You will often find it hard to persuade your friends to keep out of such enterprises. The words of the promoters—"No one believed in the railway or telegraph when they were new"—having potent effect. Manufacturing establishments of reputation have been carried away by the better class of enterprises of the general kind mentioned, and the results being unsatisfactory usually, *true science has to suffer*, and you will find it impossible, in many cases, to interest really sensible men in some simple experiments, which would enable them to make improvements that would largely reduce their working expenses. The increase in the number of educated engineers is, however, making an improvement, as some of them have the patience and tact, *after establishing themselves, as I previously mentioned*, to carry their points and initiate reforms. Rarely, however, in practical life, can experiments be made other than for practical ends. There are, of course, exceptions, when new manufacturers, striving for position, wish authoritative statements of the performances of their machinery, and others are thereby obliged to do likewise. The success of the



THE HERRESHOFF ENGINE.

testing laboratories connected with this Institute shows, that many people are awake to the importance of experimental data; but, after all, the number that stay away is so very large in comparison, that you will find the average manufacturers influenced in the manner I have stated.

* * * * *

It is absolutely necessary for success in life to preserve the health. What is a partial success to a man who is an invalid, when he should be in his prime? It may be accepted as a fact, that severe fatigue only serves to exercise the parts affected, if followed by necessary rest. So it is necessary, hereafter, to follow out rigidly a system such as you have been accustomed to in this place. True, it is often impossible for engineers to be regular in their labors. They must think and act irregularly, in order that the various operations affecting others, may go on *regularly*. When continuity of labor is a system, as on shipboard, relays keep everybody fresh; but after a break down, no rest is possible, till matters are set right; and once in port, the manufacturers must follow the same plan till everything is in shape for the next voyage. These occasions are not so trying as literary work attempted in connection with practical duties; or, worse yet, when continued uninterruptedly without any relief for the mind. It may occasionally be necessary to undergo severe mental strain, but if continued without proper rest, the final result is certain. My experience in the navy and experimental duty afterward, enable me to state that it is not the night work of itself that weakens and destroys the constitution of active men; it is simply want of good food, regularly taken, and a sufficient amount of rest. A safe rule I have found is to determine that every Monday morning will find one as fresh as on the previous Monday morning, the extent of exertion during one week being regulated by the amount of rest required to enable one to start right on another. You may work yourselves down, *down, down*, and feel more intellectual all the time. But if there be any lurking disease in the system, or miasma in the neighborhood, that is the time you will be seized, and, perhaps, brought to death's door.

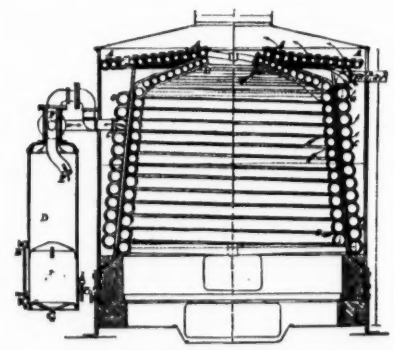
* * * * *

From what I have said, you will see that your thorough education is properly a matter of pride, though not of boasting. One starting as you do is fitted, if life be afterward a success, to grace its honors with dignity. Moreover, the proper spirit of emulation among you will spur all to exertion, and the *esprit du corps* of school associations be a shield, if nothing else will, against staining your hands in vice and corruption. Years in advance of this time you will look back to the few days spent here as the happiest of your lives, and school experiences, triumphs and rewards ever be a topic of conversation as you meet one another again.

In closing, I wish to thank you for your attention, and express my heartfelt wishes for your continued good health, happiness and true success. Let me add, that after the advantages that you have received at home and within these walls, there will not be the slightest excuse for you to fall into vicious or even careless habits. You can maintain your manhood whatever your lot. Never forget, in the darkest hour of temptation, the sacred word, *Mother*, and you will be so continuously reminded of your pleasant labors and associations here, that I have no fear, my dear friends, that wherever you are, or however employed, you will forget your *Alma Mater*.

Friction as a Source of Mill Fires.

Mr. W. H. Cornell says that 20 per cent. of mill fires are caused by the friction of machinery. If this is so, and there is little reason to doubt but that this is under rather than above the true percentage, there is a field opened here for the exercise of care on the part of millers. Friction, of course, is unavoidable, but the element of danger can be pretty nearly eliminated. Rapidly running machines should be on the floors where they will be most under the eyes of the workman. The heads of elevators should be made so that there will be no rubbing or catching, and care should be taken that belts, shafts, etc., throughout the mill are not brought into such contact as will tend to produce fire by friction. One point may be



HERRESHOFF COIL BOILER.

noticed here, that those parts of the mill where friction is likely to occur should not be hidden by the intervention of other machinery, but should be exposed to sight as much as possible.—*American Miller.*

The Herreshoff Marine Engine and Boiler.

The products of the Herreshoff M'f'g Co., of Bristol, R. I., have been before the public for a period of seventeen years, during which time the excellence of their machinery and the superiority of their models, both for sailing and steaming, have won for them a high place in naval architecture. The patent Safety Coil Boiler deserves more than a passing notice; we, therefore, give a detailed description by which, together with the accompanying figure, its internal arrangement and operation may be easily understood.

The feed water is pumped into the upper coil A, which serves as a feed water heater, through which it flows to the inner part of the main coil B. In the coil B, the water, as it approaches the bottom becomes more and more vaporized. When it finally reaches the end of the outer coil C, only a small portion of the water, say ten per cent., which is forced in at A, remains liquid. The contents of the coils are discharged through the pipe E, into the separator D, in which the steam and water become separated. The steam flows off through the pipe F, to the superheating coil G, from which it is taken directly to the engine. The water, which has been separated from the steam in the separator, falls to the bottom of it. The height at which it stands may be known by a glass gauge H. The excess of feed water is disposed of in various ways according to circumstances. In marine use, it is returned again to A by a supplementary feed pump, or discharged into the condenser, from which it is taken by the air pump, together with the water of condensation, from the steam used by the engine, after which it is discharged by the feed pump into the coil A. In this plan, fresh water is used, and the amount in circulation is constant. Sometimes the excess of feed water is blown overboard immediately from the separator, in which case the desired amount is made up to the feed water by allowing a small amount to flow into the condenser from the sea through a pipe fitted with an adjustable cock. When pursuing this method, the feed water contains a small percentage of sea water. In cases where non-condensing engines are used, the feed water is drawn from the sea, and the excess of feed water, which contains a large percentage of salt, is blown off.

The boiler is said to be absolutely safe from explosion, certainly a most admirable quality. It is half the weight of ordinary boilers, and steam can be raised in it with remarkable quickness, as 50 or 60 lbs. can be had in five minutes after lighting the fire. Its economy of fuel also is claimed to be equal to the best form of boilers in use.

The engines made by this company have many important characteristics. The distribution of material is well studied. The working parts are light and easily reached. The bearing surfaces are large, and the whole appearance and finish neat and symmetrical. The use of compound condensing engines for marine purposes is a step in the right direction. The advantages they possess over the old plain type are: First, economy in fuel, although the amount of coal used by a steam yacht is not large, pecuniarily considered, but the importance of economy in fuel by enabling the vessel to make a longer trip with the given amount, or by reducing the size of the coal bunkers, or the number of times of coaling up (a nasty job), must be allowed by all who are conversant with the handling of steam vessels. Again, the absence of the noise of exhaust and spurting of oily, dirty water, is a feature that would be appreciated by all. There is also an increased durability of all working parts, owing to working the steam more expansively, and, for the most part, running the boiler with natural draft alone. The Compound Condensing Engine, the cut of which is given, has a side lever air pump, with hot well and feed pump attached to it. It is the representation of the engine exhibited at the Fair of the American Institute, New York, 1879, to which, and the boiler, medals of excellence and a diploma were awarded.

The model and workmanship of the hulls of the steam vessels made by this company assure the most desirable qualities, speed, seaworthiness, and durability. These vessels, considered as a whole, are characterized by the fullest excellence in design and workmanship—by their finely cut lines, and by symmetry and good proportions preserved in all the interior fittings and arrangements.

For stopping holes in castings, or for covering scars, a useful cement may, it is said, be made of gum arabic, plaster of Paris, and iron filings; and, if a little finely pulverized white glass be added to the mixture, it will make it still harder. This mixture forms a very hard cement that will resist the action of fire and water. It should be kept in its dry state and mixed with a little water when wanted for use.

Improvements in Steam Pumps.

The accompanying illustration represents a sectional elevation of the Deane Steam Pump, as now constructed by the Deane Steam Pump Co., of Holyoke, Mass., and 92 and 94 Liberty St., New York, John H. Harris, Manager.

The steam cylinder is represented by 1, in the bore of which is fitted an ordinary piston, the rod of which is continued through into the water cylinder, where it is connected with the water piston. The steam is admitted to and from the steam cylinder by the two steam ports and one exhaust port, such as are used in general practice. These ports are covered by a plain D valve 16. An auxiliary valve 17, is made in the shape of a hollow square, the two valves being located on each side of the main valve, these two valves being connected by a cross-bar at each end of the main valve. The object of the auxiliary valve is to open and close the small steam ports through which steam is admitted to the valve piston, by which the main valve is operated. The valve piston 9, is closely fitted to the hole through the valve chest 4, though not tight enough to hinder it from moving freely. The reader will notice that the cylinder in which the valve piston moves is steam jacketed, so that steam may circulate freely about the valve, thereby avoiding the trouble and danger caused by unequal expansion and sticking of the valve in starting a pump when the iron is cold. Cylinder heads are frequently knocked out from this cause. Motion is communicated from the piston to the auxiliary valve by means of the tappet arm 11, and the valve-rod 24, to which the two tappets 20, are attached. When the piston is near the end of its stroke, the tappet arm 11, comes in contact with the tappet 20, thereby moving the auxiliary valve 17, into proper position to admit steam to the valve piston 9, by means of the small ports referred to; if, however, the valve piston should from any cause fail accidentally to be moved, or should not move with sufficient promptness, the lug *a*, on the valve-rod 24, moves up, and, engaging it, compels it to move by the power derived from the main engine.

It will doubtless be seen, from the foregoing, that the main valve 16, is driven by the direct pressure of the steam operating upon the alternate ends of the valve piston 9, (this is done in some other pumps). The steam being admitted and exhausted by the flat side (or auxiliary) valve 17, or, if the valve piston fails to be driven by this pressure alone, the whole power of the main engine is exerted to compel its action. It will be noticed that this engine is composed of very few pieces numbering about twenty in all; the liability, therefore, to get out of order is proportionally small.

The whole of this valve motion is contained in the space between the steam and the water cylinder. The valves are made of cast steel, for durability, with flat faces, so that they may be easily and quickly faced.

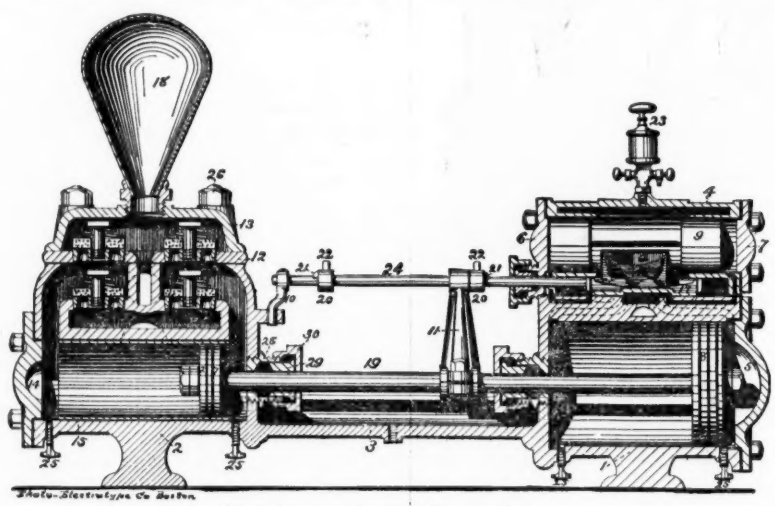
The principal points of this pump in conclusion are: It has no dead center, therefore it may be started at any point of the stroke, for the reason that the automatic part of the valve motion is never depended upon, as it has a straight mechanical connection between the piston and main valve. A full stroke of the piston is always insured, and may be shortened at will. All parts are now being made to gauges, and are interchangeable.

A large horizontal double plunger mining pump has just been shipped to the mining districts of Pennsylvania; cylinder, 30," water cylinder, 14," stroke, 36" and weight upwards of 14 tons.

A new company has recently been organized, and prominent among the stockholders we notice Stephen Holman, *Treasurer* Holyoke Machine Company, C. H. Heywood, Wm. Whiting, G. W. Prentiss, Emerson, Gaylord, ex-Gov. W. B. Washburn, Frank Farrel, D. B. Wesson, John Hill, and C. P. Deane, Patentee. A new shop is being fitted up with all the modern appliances, and preparations are being made to do an extensive pump business.

Standard System of Screw Threads.

The December meeting of the Master Car Builders' Association was held at their rooms, 113 Liberty St., N. Y., on the 18th ult.; the subject for consideration being: "The Standard System of Screw Threads, and the best method of maintaining exact sizes of screws, so that bolts and nuts may be interchangeable." The meeting was called to order by L. Garey, President of the Association. The meeting was well attended, and the principal manufacturers of taps and dies, also bolts and nuts, were represented. Mr. Chanute, of the Erie R. R., was introduced, and stated his experience by recapitulating briefly the contents of a paper read at a session of the Master Car Builders' held at Niagara Falls, which has since been printed in full in the Minutes of that meeting, and may be procured from the Secretary. In 1874, or thereabouts, the Erie road adopted the standard, or Franklin Institute system of screw threads. This system had already been adopted by many of the roads in this country, also some of the railroad organizations. A set of the standard taps and dies had been procured and sent to each of the shops on the Erie Railway, which, as they wore out, were replaced by others made from the originals at each of the different shops. In 1876, it was discovered that bolts and nuts made at each of the shops referred to would not interchange. Specimens were therefore



SECTION OF DEANE STEAM PUMP.

ordered from each shop which were sent to Pratt & Whitney for inspection. The results were here shown on the table, in the shape of about forty specimens of nuts which were split in the center, and a piece of the end of a bolt of each size attached to each one. These specimens would not fit each other for obvious reasons, the result of this being a source of constant trouble and expense. The bolts being about $\frac{1}{32}$ of an inch over size, necessitated the expenditure of $1,000 for about 35,000 lbs. of superfluous material. It being found necessary to come down to exact sizes, orders were given to stop the manufacture of taps and dies in the different shops, and to purchase the same from manufacturers of that class of goods. This course was found to be much cheaper, besides avoiding the evils which existed before.

Trade was solicited by the different manufacturers, but it was found that their taps would not interchange, as they did not have a uniform system of gauges, differing in some cases .001 of an inch, and in others a less amount, but enough to make a bad fit. It is very desirable to have all the standards of the different manufacturers made alike. It being necessary, under these difficulties, to purchase exclusively from one manufacturer.

Mr. Forney stated, in explanation, 'that the object of this meeting was to get the manufacturers together, to hear the grievances and see if they could not agree upon the right standard, and all work in accordance with it, thereby saving further trouble.

Mr. Garey here gave some illustrations of the great trouble and expense encountered in replacing lost nuts upon cars that are used for through freight traffic, and expressed a strong desire that the co-operation of all present might be secured to relieve the present difficulties.

Mr. Grant stated, in answer to an inquiry, that the demand for taps and dies over size (that is, a tap $1\frac{1}{32}$" diameter, passes for a 1" and so on) is greater than those of the standard size; also, that the firm whom he represents, are doing a sort of missionary work in laboring for the conversion of these over-size people to the standard size, and are successful in six cases out of seven. Everything made in their shops at the present time, is made on the "Sellers' system."

MR. SELLERS' ADDRESS.

I may premise, perhaps, by saying that what I have heard to-night has entirely changed my mind as to the purpose for which I was invited to be here.

I supposed, when Mr. Forney asked me to be present at this meeting, that it was desired that I should endeavor to explain away what difficulties might exist in making the size of the flat on the top or bottom of the thread or in getting the angle right, or something of that kind; when he stated in his letter to me the difficulties the car-builders had encountered in making the work of their taps and dies interchangeable, it was a matter of great surprise to me, and I assumed, perhaps too hastily, that this difficulty had its origin in the system of screw threads to which he referred.

* * * * * * * * * * * * *

I am a little taken back, therefore, by finding that there is no difficulty in that direction at all.

The question seems to me to resolve itself into this: How shall we ascertain what is a correct inch or quarter-inch, or half-inch? It would not make any difference if you all adopted our standards of measurement, or if you adopted any of the standards and were all satisfied to work to that particular one.

When I proposed this system (Franklin Institute) of screw threads, I supposed that everybody would make his own taps and dies, as heretofore, and it was my hope that an interchangeable system would result because everybody would make his own in the easiest and simplest way. We continued to make our own taps and dies for a long while, but, in process of time, manufacturers of the standard taps and dies grew up in the country, and we found that it was cheaper for us to buy than it was to make them ourselves; we insisted, however, upon having them right by our standard. When they did not come right by our standard, we rejected them; but we have never experienced any difficulty in procuring taps and dies that would make interchangeable work, and this brings me to suggest that as the manufacturers of taps and dies have grown up in the country, when the demand for their work was sufficient, so at this time the making of gauges is established—only very recently perhaps—within a year or two. It is a very difficult thing to make a gauge that will be right; in fact, it is impossible to make one that will be so nearly right that no error can be detected in it. But there are practical limits within which we must work commercially, and within which we can attain interchangeable work, and if gauges can be made with this degree of accuracy, they would answer our purpose, so that practically their differences would amount to nothing. Now, I would suggest that the parties interested in this matter should make it the interest of the gauge manufacturer to produce a set of standard measures which all could accept as such, and I suggest this because it seems to me that the trouble does not lie with the system of screw threads. No difficulty seems to exist there. The difficulty is the original one of what is an inch, and until that has been settled, I do not think it is worth while to discuss the forms of threads; whether they shall have flat tops and flat bottoms or round tops and round bottoms, the difficulty would exist, and they would not be interchangeable unless we could agree what should be the standard and what variation from that standard should be permissible.

Early in our endeavor to establish a system of standard threads that would interchange, we were frequently asked to make taps of a larger size than the standard, the complaint being that we cut away so much of the iron as to destroy the value of the bolt. Now, that was perfectly true. If you take a half inch and a thirty-second for a half-inch, or three-quarters and a thirty-second for a three-quarter inch bolt, and then cut it to the standard size, you will certainly cut away a thirty-second of an inch, unnecessarily, for the purpose of making a screw thread. The difficulty exists because almost all iron is rolled to full size. We had the same difficulty in establishing standards for shafting, many years ago. We found that $\frac{1}{16}$ of an inch was sufficient to turn to our standards; that is to say, if the iron was two inches and no more, we could make good work. If it was less than two inches, we had difficulty. We required, therefore, that the mills making our orders should make the iron measure what it purported to be, and, for a time, we had difficulty in obtaining it. After a time, however, that difficulty disappeared, and I am perfectly satisfied there will be no difficulty in getting bolt-iron to standard sizes, if the public who use it insist upon it.

It is scarcely worth while to have a difference of $\frac{1}{32}$ of an inch in bolts that purport to be $\frac{1}{2}$ inch, or $\frac{5}{8}$, or $\frac{3}{4}$; in fact, it would be a positive nuisance to have such various sizes, because, to assort them, we must measure them. The difference between a $\frac{3}{4}$ and a $\frac{5}{8}$ inch bolt is evident at sight, and we ought to have our sizes vary enough to be detectable by the eye. The only excuse for such minute variations that can be offered is, that the iron, as it now comes from the mills, is almost always over size; but this, as I said before, can be remedied whenever we really mean to have it corrected.

There is just one word I should like to say, following up the suggestion of Mr. Stetson with reference to hardening gauges. It is quite possible to make interchangeable screw gauges, so long as you keep them soft, in which case they would answer perfectly for reference; but, in our works, we do not use such screw gauges at all. We depend upon measuring the outside diameter at the bottom of the thread, the angle of the thread, the flat top and bottom and the pitch. We have purchased taps from nearly all the manufacturers; sometimes their work does not come right according to our method of measuring; but we depend entirely upon that. If the outside diameter is right, the size at the bottom of the thread is right, the angle of the thread, the pitch and the flat top and bottom are right, all of which can easily be determined by measurment, we accept them. We do not attempt to screw them into any gauge of that kind, and I believe that, practically, all the bolts and nuts that car builders use would be interchangeable if the taps were measured in the way I have described. For this purpose, it would be only necessary to have sets of gauges that would be suitable for general work—standard calipers, in fact. I do not think that you would help the matter much by having a gauge to screw your work into, because, if it is hardened, the chances are that it won't be right—and, if it is soft, it won't last half a dozen times before the size will be altered.

If any one will take one of these taps (taking one from the table) and examine it, he

will see that the flat at the top and the bottom come so close together that almost any body can detect a difference, if it exists, by the eye alone. The measurement of the outside is to the last degree simple, the bottom of the thread equally so, and if these are right the eye will detect an error, if it exists, in the flat top and bottom. With taps selected by such measurements, I do not think there would be any difficulty in getting work that would be practically interchangeable.

(Referring to a remark of Mr. Stetson's about standard gauge) I think there is nothing better so long as it lasts. But consider the great number of times that it must be used. It could not be long before it would be used up. I think it quite good enough for such purposes to select a new tap, which has been measured and found correct, tap a dozen nuts with it, and give them to the boy who is cutting the bolts to be used as his gauge. If he has a good machine he will rarely require to test his bolts, so that a few such inexpensive gauges will serve for many hundreds of bolts, and when unfit for gauges, they remain good nuts for practical use. Even hardened gauges will wear, but when worn they are useless.

I must say, Mr. Stetson, that I regard that as absolutely impracticable. If the thread has been distorted at all by hardening, it is impossible by any process, not unreasonably expensive, to bring it to the condition of a standard gauge, and if made standard before hardening, it would be absolutely impossible to restore it. You add so enormously to the cost of the production without any commensurate gain, that I should be loth to recommend the adoption of a system that would require such expensive machinery to determine whether you are right or not. I do not believe that for the practical purposes of car builders they require anything like that. Their works will be interchangeable if they measure their taps in the way I have described—indeed, I believe they will obtain better work by selecting their taps by measurement than by gauging them into a hardened standard nut, as in the latter case the tap will probably be too small to commence with.

Mr. Forney expressed an earnest desire of getting a strong expression from the meeting against the vicious practice of making taps and dies over size, in order to influence the railroad companies as the matter must be left at their discretion.

Mr. Garey stated, that in car construction bolts and nuts of even size are now generally used. In his experience, where the manufacturers of iron were allowed to furnish bars $\frac{1}{32}$ of an inch over the size, they would make it $\frac{1}{16}$ of an inch in some cases. He desired a standard system. The New York Central and Hudson River Railroad. make all their own taps and dies, because of the variation in the standards of the manufacturers. It is, no doubt, more expensive.

Mr. Stetson expressed his conviction that the Sellers system is the best, and the fallacy of looking for anything better, as it requires fewer measurements and special tools in its production. It is very necessary to have standard gauges hardened. Specimens were here shown illustrating the change which takes place in a tap by tempering, and which has never been overcome.

This drawing of the thread, though slight, and not showing in the thickness of a common nut, will become so tight on a thicker nut as to make a bad fit or break the bolt. In order to preserve an interchangeable system, a tap must not be used after it has been worn down below the size, as it will destroy the system; therefore, a limit should be established at which to condemn a tap. All dies that cut and finish a thread at one cut should be called "solid dies," and those that commence on the outside and feed in (thereby taking several cuts), should be called "adjustable dies."

Mr. Grant stated that the Pennsylvania R. R. uses the Franklin Institute standard. Pratt & Whitney furnished that company with about two dozen ¾" taps, which interchanged without any difficulty.

By a system of manipulations recently perfected in their shops, they can produce hardened steel gauges, which are not only interchangeable, but the angle of the thread, and the pitch are made perfect.

Mr. Forney stated that the principal difficulty seems to be that the manufacturers are unable to agree upon a standard, but should get together and settle upon such standard system of measurements, and all should agree to work to it. Mr. Sellers has stated that if the diameter outside, the diameter at the root of the teeth, the angle of the thread, and the flat portion, top and bottom, are all correct, it is easily determinable, whether they are right, by any car builder.

Mr. Stetson remarked that if the manufacturers were backed up by the master car builders, if they would come to them for their standards, there would be no difficulty, and, until that is done, each will have a standard.

Mr. Grant stated that the Pratt & Whitney Co. have spent about $30,000 for gauges, and yet are willing to throw aside those gauges and adopt the system selected, if the railroad people will give them sufficient encouragement.

Mr. Stetson remarked that if the master car builders would provide themselves with a set of the standard gauges and test all the new taps purchased by those gauges, and, if they do not agree, there will be no room for argument.

Mr. Garey stated that the manufacturers ought to come together and decide upon and adopt one standard system, in order that railroad companies might have the the benefit of the competition in the tap and die manufacture, and until this is done there will probably be very little change from the present system, the object of this meeting being to bring up this matter, and see if the change cannot be accomplished. On motion, a vote of thanks was tendered to Mr. Sellers and the representatives of the different manufacturers for their presence and co-operation.

The meeting then adjourned.

Peerless Damper Regulator.

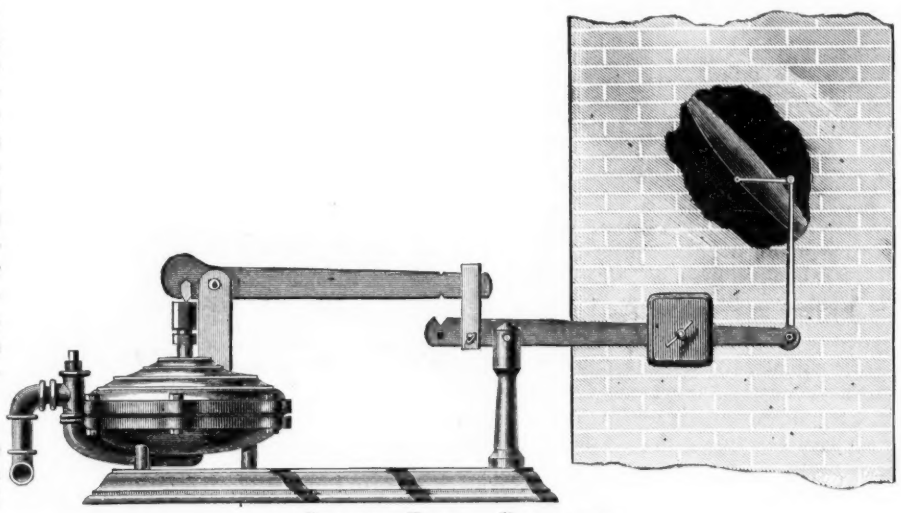
We give herewith an engraving of a new automatic damper regulator, recently patented, embracing several novel and valuable features, among which are the following:

A large increase of leverage movement and sensitiveness, by the use of a compound lever—an adjustable fulcrum, by means of which the same machine is adapted to the use of either high or low pressure—a siphon attachment, which precludes all contact of steam with the diaphragm, and a rolling diaphragm perfectly supported, and it is claimed, preventing any stretch or wear, and largely augmenting the durability of the same.

The advantages of this regulator will be readily understood and appreciated by practical engineers, from the engraving. The objects gained are claimed to be a great saving in fuel, a steady power, a regularity of speed, and a guaranty of safety from explosion, by excessive steam pressure.

It is claimed that it will control the pressure of steam within one pound, and *fully* open or close the damper on a variation of two pounds.

This damper regulator is manufactured solely by the American Steam Appliance Company, of 13 & 15 Park Row, New York, and 28 School Street, Boston, Mass.



PEERLESS DAMPER REGULATOR.

An Explosion Theory.

BY J. O. BUERCK, M. E.

A favorite theory among engineers in explaining certain mysterious boiler explosions is that of the "spheroidal state," or, in other words, that phenomenon which takes place when a drop of water is thrown upon a highly heated plate of metal. It will at first jump about on the surface, then is suddenly decomposed. It is claimed by these engineers that an identical phenomenon takes place when water is fed to a boiler in which the crown-sheet has become overheated; an enormous amount of steam is suddenly formed, followed by corresponding rise in pressure and a break in the weakest part of the boiler.

This theory has, however, many skeptics, all claiming that this phenomenon cannot take place under ordinary conditions of firing, even when the plates may have become overheated through carelessness.

The observations and some experiments of the writer bear out this latter idea. From these experiments and observations, we would claim three things, and as follows: 1. That under ordinary conditions of overheating such phenomenon cannot take place. 2. That when such things do take place, the explosion is not due primarily to the fact that an "enormous amount of steam is suddenly formed," but is due to the dissociation of the cushioning vapor into its two elements, oxygen and hydrogen. 3. That such phenomena do take place and under conditions which the writer believes to have been unsuspected heretofore.

These experiments were as follows: A sheet of boiler iron was heated up to a temperature of about 1,200 degrees, Fahr. It was then slowly lowered into a bath of clean water, the surface of the plate being kept parallel with that of the water. It entered with a hiss and a roar, followed immediately by great clouds of steam. Following out the ideas of the writer, a small amount of grease (glycerine) was added to the bath and well stirred. The plate was again heated and lowered. As was surmised, it entered smoothly, without noise or visible formation of steam. The following result was even more wonderful: When the plate reached a point below the surface of the bath, it seemed to be covered on all sides by a bounding cushion resembling polished steel in color. Upon lowering it still further, the thickness of the cushion seemed to decrease until the plate had reached a depth of fourteen inches, when further progress was debarred by the shallowness of the bath. The diminution in thickness of the elastic cushion was not altogether due to the difference in hydrostatic pressure at the different depths, for, when the greatest depth was reached, the cushion became thinner, until at the end of seven seconds after entering the water it disappeared, followed by a tremendous evolution of gas and then by steam, effectually wrecking the bath and stopping further experiment.

It is therefore argued that the presence of foreign organic matter may produce such phenomena as that of the "spheroidal state," on a scale such as that of the explosion of boilers. These experiments show that it materially helps in producing this cushion of watery vapor, which, when the temperature has reached a degree at which the elements are dissociated, is decomposed, allowing successive cushions to be formed, until, by this action, the temperature of the plate is lowered below that at which this dissociation takes place, viz. about 1300 degrees Fahr., depending on the pressure in the boiler. When this temperature is attained (that below which such dissociation takes place), steam may be formed in quantities large enough to produce dangerous pressures. Cases are known which bear out this idea. The explosions did not take place immediately upon the introduction of cold water, but very soon afterward, and as the writer thinks, not until the successive dissociations of this cushion of vapor have lowered the temperature of the plate below that at which such things take place; and that the formation of such cushions of watery vapor, if not caused altogether, is at least augumented by the pressure of foreign organic matter, very probably oil or grease. It may be argued that oil or grease is not fed to boilers in sufficient quantities to produce this, but the writer knows of a case of a battery of four marine boilers in which balls of grease and scale had been formed up to four inches in diameter, by the rolling of the ship, zinc plates having been used as a scale-preventive. In this case, oil had been fed to the cylinders in large quantities, passing thence through the condenser into the boilers.

Original Enterprise.

So in the business of life, it is very pleasant to settle quietly down into a beaten track; and when we do, how we hate to be disturbed! When some uneasy fellow points out an unexplored path and wonders where it leads, how quickly we give him a thousand reasons why no investigation should be made, and why he should keep just where he is, or have his vehicle broken in pieces. Sometimes, unconvinced, he starts off alone to explore, and then, perhaps, when we have almost forgotten him, we hear that down that path which we fought so hard to keep him out of, our restless friend has found a bag of gold—that he is rich. Then pellmell we follow in *his* track, and although the change may bring us no profit, we are ready to quote to all others the good fortune of our predecessor as a reason why they should simply follow him.—*The Hub.*

To Test Glue.

An article of glue which will stand damp atmosphere is a desideratum among mechanics, especially pattern makers. Few know how to judge of quality, except by the price they pay for it. But price is no criterion; neither is color, upon which so many depend. Its adhesive and lasting properties depend more upon the material from which it is made, and the method of securing purity in the raw material, for if that is inferior and not well cleansed, the product will have to be unduly charged with alum or some other antiseptic, to make it keep during the drying process. Weathered glue is that which has experienced unfavorable weather while drying, at which time it is rather a delicate substance. To resist damp atmosphere well, it should contain as little saline matter as possible. When buying the article, venture to apply your tongue to it, and if it tastes salt or acid, reject it for anything but the commonest purpose. The same operation will also bring out any bad smell the glue may have. These are simple and ready tests, and are the ones usually adopted by dealers and large consumers. Another good test is to soak a weighed portion of dry glue in cold water for 24 hours, then dry again, and weigh. The nearer it approaches to its original weight the better glue it is, thereby showing its degree of insolubility.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Prest.
LYCURGUS B. MOORE, Treas.
JACKSON BAILEY, Vice-Prest.
DAVIS STRONG, Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, Mechanical Engineer.

The American News Company.

Publishers' Agents, New York.

The International News Company,

(Formerly the Willmer & Rogers News Co.)

11 BOUVERIE STREET, (Fleet St.) LONDON, ENG.

Will receive subscriptions for the AMERICAN MACHINIST at 17 shillings per annum, postage prepaid.

DEALERS SUPPLIED BY

The New York News Company, New York.
The National News Company, New York.
The New England News Company, Boston, Mass.
The Central News Company, Philadelphia, Pa.
The Western News Company, Chicago, Ill.
The St. Louis Book and News Co., St. Louis, Mo.
The Cincinnati News Company, Cincinnati, Ohio.
The Detroit News Company, Detroit, Mich.
The Pittsburgh Book and News Co., Pittsburgh, Pa.
The Baltimore News Company, Baltimore, Md.
The Rhode Island News Co., Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The Brooklyn News Company, Brooklyn, L. I.
The Newark News Company, Newark, N. J.
The Northern News Company, Troy, N. Y.
The Albany News Company, Albany, N. Y.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.

$3.00 a year, in advance, postage prepaid in the United States and Canada.
$4.00 to Foreign Countries, postage prepaid.

ADVERTISING.

Outside page, 45c. per line, each insertion.
Inside pages, 25c. per line, (12 lines one inch.)
Business Specials, 40c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ Subscribers who fail to receive their paper promptly will please notify us at once.

☞ Entered at the Post Office at New York, N. Y., as second class mail matter.

NEW YORK, JANUARY 17, 1880.

CONTENTS.

	PAGE.
How Paper is Made	1
Extracts from Chordal's Letters	2
Machine Finish. F. G. Woodward	3
Two Foot Gauge Railroad	3
Steel and Steel Making.	3
Practical Draughting. T. P. Pemberton	4
Address to Student Engineers	4
Friction as a Source of Mill Fires	5
The Herreshoff Marine Engine and Boiler	5
Improvements in Steam Pumps	6
A Standard System of Screw Threads	6
A Good Sign of the Times	8
Cheap Small Power Engines	8
Imaginary Evils of Steam Power	8
Premature Revelations	8
Letters from Practical Men	9
Questions and Answers	9
Manufactures.	10
Machinists' and Engineers' Supplies	10
Iron Review	10
Metal Review	10

Several of the leading Philadelphia firms are calling in their salesmen, having their factories so fully employed that they need ask for no more orders.

A Good Sign of the Times.

Most of our readers can doubtless recall the article that appeared in the AMERICAN MACHINIST of Nov. 15, 1879, entitled, "Advancing Wages an Important Element of Prosperity," in which attention was directed to the huge dimensions of the "wages-spending boom" in this country, and the impetus that general business would receive from such increased spending, as a natural consequence of an advance in wages.

In the course of the article we took occasion to say:

Those employers of labor, therefore, who take the strictly selfish view of the wages question, do so in direct disregard of their own true interests. It is safe to say, that, if great employers, such as Vanderbilt or Scott in railway circles, instead of trying to screw their thousands of employees down to the lowest starvation notch (as is notoriously the case among their track laborers) had, even in the dark days of the past two years, voluntarily raised all wages under their control to a figure above the prices that other roads were paying for like service, and by extensively advertising the fact, had forced other railroads and other employers in all lines of business to do the same, they might almost have laid the foundation of good times, such as we are now enjoying. Earning more money, and helping thousands of their fellows to earn more—these thousands would have spent more, giving thus an impetus to almost every branch of trade or commerce, and the railway magnates would have had their reward in improved business.

As a corollary to the above (the article in question having been widely copied), we are pleased to note a semi-official announcement, published, Dec. 29th, by a prominent official of the Pennsylvania Railroad Company, who states that, some time early in the spring, there will be an increase in the wages of the employees of that corporation, from the highest to the lowest. It is further stated:

The officers claim that if they increase the wages of the employees of their road, it will compel the New York Central, Erie, and all the other great trunk lines, to do the same thing. Therefore, it is believed that when the increase is announced for the Pennsylvania Company, it will be simultaneous on the roads named above.

From which, it will be seen, should this seemingly authoritative statement prove to be correct, that one of the gentlemen referred to by name, in our article of Nov. 15, has had the penetration to see that a general advance in wages of the kind named can be relied upon to stimulate business, exactly as a liberal use of fertilizers can always be relied upon to increase the yield of land. Or, in other words, as stated by us in the editorial referred to:

The true policy for nations, firms and individuals is the whole-souled policy that devises liberal things, and compels everybody else to follow suit.

Cheap Small Power Engines.

Within the past six or seven years a vast amount of ingenuity or craft has been expended in devising and constructing cheap small power engines. The object, in most cases, seems to have been to produce some kind of a steam motor that would keep in running order for a few weeks and that could be sold at a very low price. The number of semi-worthless engines, some with and others without boilers attached, that have been disposed of within half a dozen years is a matter of wonder. Most of them have a good appearance when new, and as most purchasers of small power motors know very little about machinery or steam engineering, they attract many admiring customers. One-horse power engines, with cast-iron boilers, have been selling as low as $100, and engines alone of that capacity have been selling as low as $75. Perhaps this is not the very acme of cheapness, but some of them sold at these prices strongly remind us of jack-knives with pewter blades, and are probably about as serviceable. A case is on record where a printer bought a new engine for $150, which, in five months' usage cost him over $250 for repairs, besides losing him several good jobs of work by not being in condition to run when power was wanted. He was determined not to pay a high price for an engine, and accordingly obtained one at a price to suit. This case is but a sample of hundreds of others which are frequently occurring. It may be thought that dear experience would enable users of steam power to see the folly of throwing away money upon trashy engines, but as there are always a large number ready to acquire experience, the lesson will be learned by many more before the close of 1880, and the tuition roundly paid for.

Imaginary Evils of Steam Power.

It is amazing to see what foolish and harmful harangues men of supposed superior mental endowments sometimes deliver to workingmen. If they really believe what they express, there is often sore need of common sense in distinguished individuals. The following effusion will bear criticism, as a specimen of literary composition, but what should we say of the soundness of the ideas? It is the peroration of a lecture by Prof. W. E. Ayrton, recently delivered to four thousand workingmen of Sheffield, England, on the subject of electricity as a motive power:

"We are, it is true, a commercial people, but do we not still love our hills and our fields? There was a time when the cutler of now black, grimy Sheffield was very fleet on foot in following the chase. There was a time when 'not only in the villages around old Sheffield,' so says the history of Hallamshire, 'were the file-makers' shops or the smithy to be seen, with the apprentices at work; but even on the hillside in the open country, at the end of the barn would be the cutlers' shed, while in the valley below, by the river, was the grinding wheel ready to sharpen the tools that had been manufactured.' And why not now? why should not the mountain air that has given your workmen of Hallamshire in past times your sinew, your independence of character, blow over your grindstone now? Why should not division of labor be carried to its end, and power brought to you instead of you to power? Let us hope, then, that in the next century electricity may undo whatever harm steam may have done during the last, and that the future workman of Sheffield will, instead of breathing the necessary impure air of crowded factories, find himself again on the hillside, but with electric energy laid on at his command."

The learned professor might also have raised his eloquence against the harm done during the last century by hard coal. He could easily have drawn a picture of suffering coal excavators toiling in the impure atmosphere of damp and badly-ventilated mines, and contrasted their condition with the wood-cutters and turf-diggers of yore, when the mountain air and the open country gave them sinew and independence of character. Prof. Ayrton is silent upon the question of the great wrong done the workingmen of England, by obliging them to breathe "the necessary(?) impure air of crowded factories" and treating them as so many animated machines, rather than sensitive members of the human family. He, like other British professors, seems blind to the avarice and heartlessness of the factory owners of his country, who, upheld by the "strong arm of government," systematically grind their operators down to the meanest kind of existence to be found in a civilized country, in order that they themselves may live in luxury and idleness. While the evils of steam are so often bemoaned, the real causes of suffering labor are obscured. Steam power and machinery have made it possible for the workmen to enjoy far greater comforts, and higher opportunities for mental and social improvement, than they could obtain before the days of James Watt. Whether electricity can supply a better or a cheaper power for manufacturing purposes is an open question, but no developments have yet been seen that will warrant an answer in the affirmative.

Premature Revelations.

Letting the cat out of the bag in advance, is a weakness that causes trouble to a great many individuals. Whether it arises from an over-sanguine, an impatient, or a careless cast of mind, it is none the less an unmixed evil. The man who is always announcing his discoveries, his purposes, and his methods in advance, can usually, in most cases, be set down as one whose discoveries will be credited to, or made by somebody else, whose purposes will be anticipated, and whose methods will be adopted or improved upon by others, to his very great chagrin and disappointment.

None but a most royal mind, confident of its own resources, because conscious of rare superiority of endowment, can pass this test without being floored by it. The path of mechanical progress, in particular, is strewn thick with melancholy examples of inventors, who by taking the public into their confidence too soon, have been unable to take the public into their confidence ever afterwards, and have become so soured, with neglect and loss of opportunity, that their minds have finally shrivelled up as flowers do, when the season of bloom is past.

The poet Gray, in his "Elegy in a Country Church-yard," speaks of the "mute, inglorious Milton," who never achieves success, though fully capable of it, and had his mind been turned to things mechanical, might have penned at least another stanza to good purpose.

Cultivating the habit of doing first and speaking afterwards, and then with caution, where suggestive matters are concerned, is a habit that can hardly fail to pan out good returns in any relation of life.

All around us are men who are sure that they could have invented such and such mechanical marvels, if the lucky inventors had not happened to live just a little too soon for them. But other, if lesser, plums hang close about their noses daily without being seen, much less plucked and eaten.

Speaking of binding, a valuable feature of a bound volume of the AMERICAN MACHINIST is the bird's-eye view of mechanical progress shown in its advertising columns. And, ten or twenty years hence, these columns will inspire in the mind of the discerning reader an interest which they do not inspire to-day.

The year 1879 goes out with little of commanding interest in the way of great mechanical discoveries to show as its special contribution to the world's work. Every inch of ground, now-a-days, is so closely covered that great achievements, or the opportunity for them, which is much the same thing, are, of necessity, rare. But many little advances have been made, and, altogether, the world is better off, mechanically considered, than it was twelve months ago.

The "Monitor Binder" for the AMERICAN MACHINIST, which we illustrate on another page, is a handy thing to have in the house. It keeps the successive issues of papers (whole years) neat and clean, while readily accessible and always together, and at the close of the year, the papers may readily be removed for regular binding, and the "Monitor" is in shape for use with the new volume.

A new industry for American machine shops is the building of portable railroads for export to the West Indies. The rolling stock used consists of light four-wheeled platform cars, weighing less than a ton, which are capable of carrying over a ton of load. Locomotives of very light pattern have recently been introduced.

Mr. Frank C. Smith of Delaware, O., has been making a miniature steam engine, believed to be the smallest ever constructed in this country. The engine and boiler are made of brass, and will rest on a space the size of a three-cent piece. The boiler contains water gauges and safety valve; the engine, of course, is composed of cylinder, steam chest, balance wheel, etc. The stroke is three-sixteenths of an inch in length; the bore is three thirty-seconds of an inch in diameter, and the balance wheel three-eighths of an inch in diameter. The boiler is heated by a spirit lamp, and the velocity of the engine is 3,000 revolutions per minute.

Letters from Practical Men.

DIFFERENT MIXTURES FOR BRASS.

Editor American Machinist:

DEAR SIR:—An article appears in your issue of Dec. 13th, under the heading of "Brass," credited to the "N. Y. Mercantile Journal."

The aim of all writers upon mechanical and other kindred subjects, should be, not to reiterate old, unauthentic stories about ancient arts and sciences; nor even to describe present known methods, unless something new can be added thereto, by which persons engaged in the arts which the subject treats of can derive some benefit, or receive a hint which may lead them to further progress. Entertaining these views, I feel restless when I see unintentional misstatements of facts appear in practical journals on subjects upon which there should be no doubts. This article on "Brass" evidently did not receive your careful scrutiny, or it never would have appeared in the AMERICAN MACHINIST.

If I do not trespass on too much of your valuable space, I will offer the following comments upon the article referred to.

"Corinthian brass was said to be a mixture of gold, silver, and copper, formed by the running together of statues, melted in the flames of the city of Corinth, when it was burned by its Roman captors. It brought a very high price for generations afterwards."

There is no evidence whatever, that the statues in the city of Corinth contained a mixture of gold, silver, and copper.

But suppose they did; and that they were at that time surrounded with fire intense enough to melt such a composition (and in such shape) in the open air, oxydization would be so rapid during combustion under such conditions, that but little substance would be left behind deserving the name of metal. Corinthian brass is, like all ancient history, a mixture of lying rubbish, mere dross without substance.

"A mass of zinc ore mingled with charcoal, and plunged into melted copper, will yield the metal, which will be at once dissolved by the copper. This was the ancient process, the only one till 1781, and it is still in use."

If this was the ancient process, it would be hard to determine the amount of zinc the brass contained, if the ore alone was used; hence the ancient bronzes must have been of various qualities. But I am surprised to learn that this ancient method is still in use. Yet I ought not to be surprised, when I come to reflect that, up to the present time, no proper universal system of classification of brasses has been adopted, nay, even suggested, by which users and dealers in metals could determine the exact quantity of zinc, tin, lead, antimony, or other soft metal, contained in a mixture of copper with either or all of these metals, after having once left the foundry, where they were made, or became "old brass."

The author of this article informs us that "modern modes consist in melting the zinc and adding copper in thin strips, or in a fused state; or in melting copper and pouring it into lumps of zinc held below the surface with iron tongues."

This will be news to metal workers. If the zinc be allowed to remain in the furnace long enough, and at the intense heat required to melt copper, even in *thin strips*, I am inclined to think that, upon strict search being made for the zinc, it would be found to have passed up and out of the chimney and to have fallen upon the house-tops and ground in beautiful white flakes, resembling snow, called "flowers of zinc"; and as to the pouring copper in a fused state into or upon *lumps of zinc held below the surface with iron tongues*, I am afraid it would be rather a dangerous experiment to try. It is a well-known fact that after the copper has become thoroughly melted in the crucible, great care is required in mixing in the "slab spelter," which has been broken up into convenient pieces, and laid upon the furnace covers to *heat up*. Each piece is lifted with the tongs and placed *on top of the melted copper*, which is covered with charcoal dust, and there allowed to float for a few seconds until the workman reaches for his pot-stick, or iron rod, to stir up the "heat." Thus each piece is singly and carefully incorporated, and any attempt to force the zinc into or under the surface of the copper, *while it is cold or damp*, would result in blowing the metal out into the furnace.

The idea of pouring melted copper upon lumps of zinc is to me novel, and I have no doubt the writer of the article on brass would find the experiment quite interesting.

To pour melted copper upon lumps of zinc would create as much smoke and smell as if poured on lumps of rosin only of a more disagreeable kind. If there is such a method of mixing copper and zinc, and there is any advantage gained by it, I would like to know it. Further on, he proves the absurdity of such a *modus operandi*, when he says:

"At the temperature of melted copper, zinc is very apt to evaporate, and despite layers of fine charcoal or glass on top of the fluid metal, so much zinc passes off that chemical analysis alone can determine the proportion of each metal in the product."

This burning out of the zinc should not be called evaporation; it is a complete destructive combustion, which becomes more rapid the higher the degree of heat applied, and the longer it remains in the furnace after it has became fluid enough to pour. Every moulder who desires to have his castings uniform in color and quality, and who studies his own interest, or that of his employer, makes haste to pour his "heat" as soon as his metal is melted, as he knows that the zinc burns out, and the brass, when cast, would have a yellowish green color—tough and greasy on the finished surface, and often containing small particles of iron, which become very hard, probably melted from the iron rod which the metal was stirred with while in this over-heated state.

We are also informed that, "The usual proportion is a pound of iron to eight ounces of zinc."

I presume *copper* is meant, not *iron*.

There are other references to this article which I could make, but for fear of infringing upon more than one column of your valuable space.

Yours Respectfully,

T. F. HAGERTY.

4 Henrietta Square, San Francisco, Cal.

THOSE LIGHTNING CHANGES.

"One cannot well read the articles in the AMERICAN MACHINIST without running against something to set him thinking, whether he wants to or not," said a friend to me the other day; so I asked him to explain, or state his "trouble" for the benefit of your readers. He said: "I get a copy of the MACHINIST containing an article from one writer, who maintains that my cylinder has the same varying temperature that the steam it contains has. The next week I get a copy containing an article arguing that such is not the case, by some other writer. "Which do you think is nearest right in his views?" I asked. "Mr. ——," was his answer. Now, it would not have been natural for me to have agreed with him on the subject, so we argued the question as practically as we could, pro and con. *Pro* began by saying, that we could take a small piece of iron and put one end of it in the fire, and get it white hot, while the other end could be held in the hand comparatively cold, which would not be the case if one end of the piece was to be struck by lightning. *Con* asked if he had ever tried this last experiment, and knew if what he stated was fact? His only reply was: "Take a fresh cigar, and keep quiet till I get through." In order to more clearly show that iron was not capable of undergoing such rapid changes in temperature as a cylinder would be called on to make with each induction of live steam, we cited the experiments made by C. Wye Williams with conductor-pins. This gentleman (Mr. W.) found that by drilling holes in the bottom of his boiler and inserting "pins" projecting from the boiler in the flame, that he improved the efficiency of his boiler, and also found if his pins projected more than three inches that they would get burnt off to about that length. This latter information was what *Pro* wanted to make a handle of, in his arguments, so he said that if a piece of iron three inches long can be kept at a temperature of 2,900° at one end, and, say 400° at the other, it would not be reasonable to believe that the cylinder of an engine paid any attention to the comparatively slight change of temperature of the steam in a cylinder, especially as it only had about a quarter of a second to get up the change in. To make a convincing statement, he said: "Suppose, *Con* you take a piece of iron one inch square, and heat it to the burning point, then suspend it in an atmosphere of 60°, how long will it take to cool down to 100 degrees?" *Con:* "About five minutes." *Pro* then will say it takes the atmosphere (which, as a conductor, is supposed to be nearly as good as steam), five minutes to carry off 2,800° of heat from this piece of iron, which is at the rate of 9.33° per second, or 2.33° per quarter second; now if an engine runs 120 revolutions per minute, it only allows one volume of steam a quarter second to operate on the cylinder. You see, from my reasoning, the temperature of the cylinder only varies two or three degrees, so your re-evaporation, and all that is a myth. The cylinder has the *average* temperature of the steam; that is my idea on the subject.

Now, *Pro* used to "sling" the fast mail over the —— Railway, and still loves to talk about No. 200, "the best engine that ever turned a wheel," so *Con* thought it would be a good idea, if he could pick out some part of this engine to serve his purpose in defending his views on the subject. He began by telling *Pro*, that though he had never run a locomotive, he had read the "Catechism of the Locomotive," which gave the temperature of the fire in a locomotive fire-box in an active state of combustion as being from 3,000° to 4,000°, and that this heat, after passing through the tubes, escaped at a temperature of about 700°, he did not remember of any authority relating to the velocity with which the gases traveled through the tubes; so he called on *Pro* for this information, who supposed that the "draft" traveled at least a mile a minute or faster, say 6,000 feet per minute. *Con* figured this out to be $\frac{11}{100}$ second for a volume to travel through a 11 foot tube, and in this short time to conduct about 2,500° of heat through its thickness to the water in the boiler. Lightning might have gone through the tube to the water quicker than the heat did, but still there is something akin to lightning in the rapidity with which the heat got through the tube to the water. *Pro*, who anticipated the comparison *Con* intended to make, remarked that there was usually a slight difference in the thickness of the iron used in boiler tubes and in engine cylinders, and that, if a locomotive boiler tube was made an inch thick it would be likely to get red hot in a short time, and the gases would enter and escape at nearly the same temperature. *Con:* That is just about what I was going to say, and now I wish to know, if the first volume of heated gases which went through the thick tube would not lose about as much of its heat as though it went through a thin tube. *Pro:* Perhaps it would. *Con:* Well, to compare this thick tube to the cylinder of an engine, suppose, after the first volume of *heated gases* got through the tube, you would shoot a like volume (in quantity) of *frozen* gases through it, and so alternately. This would, in my opinion, keep the tube at an average temperature, imparting heat to the cold blast, and cold to the hot blast. The depth to which the tube would be affected would be according to the time the different temperatures were operating on it, with the exception of the extreme temperatures at which this hot and cold blast is alternating in your cylinder, the effective pressure on one side of the piston heating up your cylinder, and the exhaust steam on the other side cooling it off. The depth to which the cylinder is affected, as before referred to, depends on the time the steam has to prey on it, and it to prey on the steam. Hence, if you would use it economically, at least so far as condensation steam is concerned, use it quickly. You may be right, *Pro*, in saying that the cylinder has the average temperature of the steam; but it is my opinion, that it is the *outside of the cylinder* and not the inside which has the average temperature. Thus the argument ended, and neither had convinced the other that either was right. J. H. DUNBAR.

There are over 15,000 carriage manufacturers in the United States, who employ upwards of 100,000 hands, pay out from $28,000,000 to $31,000,000 for labor annually, and produced, during the past twelve months, upward of 1,200,000 carriages, amounting in value to $125,000,000.

The steamer City of Berlin, on her last trip from Liverpool, was brilliantly lighted in the saloon and steerage by the electric light, and with so much satisfaction that its general use on ocean passenger steamers is predicted.

Business Specials.

Forty cents a line for each insertion under this head.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co., New York, or the author, Manchester, N. H.

Lathe Attachments for Milling Plane and Irregular Forms; Taps and Reamers fluted and Gears cut without removing from the lathe centers. For extended description, see AMERICAN MACHINIST, Sept. 13 and 20 issues. Send for circular to Wm. Main, Piermont, N. Y.

Tool Chests with best tools, scroll saws, wood and designs. Amateurs' and Machinists' Tools. Send for Catalogue. Tallman & McFadden, Philadelphia.

Steel Stamping Figures and Dies.—1-16" to 1-8" Figures, per set, $1.00; 1-8" Letters, $3.00. American Tool Co., Cleveland, O.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) W. C. R., New Bedford, Mass., writes: Please inform me if Edward's Catechism of the Marine Steam Engine is an American work? *A.*—Yes; Mr. Edwards is an American marine engineer of extensive experience; see notice of the book in our issue of Jan. 10th, 1880.

(2) P. K., Altoona, Pa., writes: Will you please inform me what "mineral wool" is? A substance so called is used in the car shops of the Pennsylvania Railroad in this city, for filling under the floor of the sleeping-cars to deaden the sound of the wheels. *A.*—Mineral wool is a material produced from the slag of blast furnaces, having the same ingredients as the slag, and encasing in its interstices from 85 to 95 per cent. of its volume of air, which is kept from circulation. Its inorganic nature prevents it from being destroyed by contact with heated surfaces. It is also a protection against vermin. It must be used in a porous state, being neither compressed nor cemented, as either of these will impair its utility.

(3) G. P., Indianapolis, Ind., writes: I would like to learn of a school suitable for boys to go to that have learnt the machinist trade. I desire to study drawing, mathematics, and other kindred branches. *A.*—We refer you to the Washington University, at St. Louis, as a good Polytechnic school, which was noticed in our issue of Nov. 22d, 1879, as being one of the best schools in your neighborhood. A new workshop has been added and the facilities for learning have lately been increased.

(4) G. G. M., Ottumwa, Iowa, writes: Will you please answer through your paper what apprentices get as wages during their apprenticeship? *A.*—See answer to question 3, in our issue of Dec. 27th, 1879.

(5) H. S. Robinson, Union Springs, N. Y., writes: I am very anxious to learn the machinist's trade, and to become a skilled mechanic. I would like to know the best course to follow in order to succeed. I would like to obtain a situation in a locomotive works or marine steam engine shop, especially the latter. How shall I proceed to obtain such a situation, if it is possible? *A.*—We refer you to our issue of Nov. 15th, 1879, answer to first question, where you will find all that you require.

(6) C. F. H. Lynn, Mass., writes: In one of your issues, you recommend to an inquirer Harrison's Tool Book. Does this book give all branches of machine work; such as planing, gear cutting, shaping, etc.? *A.*—The book referred to is not supposed to contain all, but is considered a good practical treatise on the subject of shop manipulations, and processes, and is a recent work.

MANUFACTURES.

George W. Fifield, Lowell, Mass., has now orders for 45 engine lathes, many of them large size; just shipped one of 48-inch swing and 22 feet to Milwaukee, and has orders for two more of the same size. He has increased his force of men from 25 to 40.

The Telegraph Supply Company of Cleveland, Ohio, are filling a $15,000 order for London, England, and a larger one for Australia.

The woolen mill of J. L. H. Cobb & Co., Lewiston, Me., is to be lighted with the Brush electric light.

Fifteen acres of land at Brightwood, near Indianapolis, have been donated as a site for car works, and a company is to be organized to build them.

The Edison Telephone Company, 100 Wooster Street, New York, are employing about 30 men. They have been working on an order for 2000 telephones for England.

A gratifying revival of shipbuilding is announced.

A shoe manufactory, with $25,000 capital, is talked of at Portsmouth, N. H.

The Barney & Smith Mfg. Co., Dayton, Ohio, have a contract to build two thousand railway cars.

Buchanan, Bolt & Co., wire cloth manufacturers of Holyoke, Mass., have doubled the number of their employees.

Many of the textile manufacturers of Connecticut advanced the wages of their help on January 1st.

The Boston *Transcript* thinks the axle-trees of railroad car-wheels are called journals because of their rapid circulation.

A new machine, capable of turning off 15,000 complete paper boxes in a day, has recently been put in operation by a company in Cleveland, Ohio.

The Weed Sewing Machine Company, of Hartford, Conn., have turned out 855 bicycles, and have now on hand, to be delivered next spring, orders for 1,700.

The *Western Manufacturer* says that new locomotive works, for the manufacture of new locomotives and the repair of old ones, are in contemplation in Chicago.

The new thread company at New England Village have made a beginning, having removed most of the old machinery from the mills. It is not expected that the works will be in running order before spring.

The 40-horse power Kendall & Roberts engine, lately put up at Lowell for Whitehead & Atherton, is the third engine that these Cambridgeport engine builders have sold to these Lowell machinists.

It is reported that a new mill, exclusively for weaving cotton goods, is to be built in Fall River, Mass., next spring, and that the stock has all been subscribed. Mr. Frederick Hathaway will probably be the treasurer of the new company.

George V. Cresson, Philadelphia, manufacturer of shafting, etc., has again been compelled to enlarge his works at the southeast corner of Eighteenth and Hamilton streets, and is now able to fill his orders, both foreign and domestic, with greater facility.

In view of the fact that American papers are making their way so well into Europe and South America, paper manufacturers are considering the feasibility of opening agencies at London, Paris, Berlin, Yokohama and Rio Janeiro.—*Paper World.*

How about machinery?

A Boston dock company, which was chartered last winter, has started with a capital of $500,000. The company will improve the Charlestown water front by building four first-class docks, with elevators and rail tracks, sufficient to load eight ocean steamers at the same time.

The I. P. Morris Company are getting out castings for a large vacuum sugar pan on, order of Philadelphia parties; four boilers for Lewis & Bros., of this city, white lead manufacturers; and a fifty-horse power boiler for a city sugar firm. They are also constructing several large extractors, eight feet in diameter and forty feet long, for the Chicago Rendering and Drying Company.

All the car shops in the Lehigh Valley are running on full time, but cannot turn out work fast enough.

At Philadelphia, the American Machine Works are building a new factory building, 50x120 feet, to be ready February 1st.

The Prescott Manufacturing Company has just been organized at 237 Washington Street, Boston, for the purpose of introducing a new style of hangers for sliding doors.

It is proposed to form a stock company at Brockton, Mass., with a capital of $25,000 for the manufacture of clothes wringers.

A large mill, exclusively for the manufacture of print paper, will soon be built at Menominee, Mich. It will contain five turbine wheels with 663 horse-power, four pulp engines, four heating engines, and one 48-inch Fourdrinier paper machine. It will cost not far from $40,000, and employ fifty skilled workmen.

The engine works of F. M. Riegel & Co., at Dayton, O., have passed into the hands of Marshall, Gravers & Co., of that city. The new establishment gives employment to one hundred and sixty hands, and will be among the finest manufacturing industries of the city.

The old Warner & Whitney machine shop at Nashua, N. H., has been started up with orders sufficient to keep the works in full operation for the next year. The heavy work in hand is the manufacture of four eighty-inch turbine water wheels weighing sixty tons each. Two are for the new Amory Mills of Manchester, and two for the Hamilton Mills of Lowell.

The Ashuelot, N. H., steam mills, which have been idle for about twelve years, are to be started up in the manufacture of furniture, and will employ about 100 hands.

The Farist and Windsor Company, Windsor Locks, Conn., have all the business they can attend to. They are turning out ten tons of steel a day. The Company furnish steel for the Bridgeport Sewing Machine Companies and for Western railroads, the latter using it for car springs. This factory, which is said to be the largest of the kind in the United States, is so troubled to fill orders that men have been put on to work nights.

The new Deane Steam Pump Company, Holyoke, Mass., have taken possession of the shops formerly occupied by the Chapman Cutlery Company, and are putting in steam heating apparatus. The machinery for the works is all bought, and will be put in as soon as the rooms can be made ready for it.

It is rumored that the Pullman Palace Car Company have selected a site near Laclede Station, on the Missouri Pacific Railroad, for the erection of their car works, in which, it is said, they will employ from 1,000 to 1,500 skilled mechanics.

On Jan. 1, the Laclede Rolling Mills, of which Chotteau, Harrison & Valle are proprietors, will resume operations with a force of 500 men.

From all parts of the country (except the Pacific coast) comes information of an increasing machinery business. Many shops, both large and small, are running over-time with a full force of hands, and signs of prosperity are abundant. Indications point strongly to a most gratifying year for all well-founded machinery industries.

Machinists' and Engineers' Supplies.

NEW YORK, Dec. 31, 1879.

All the supply dealers are polishing up, preparatory to making a round of New Year's calls to-morrow; consequently, news items are scarce. Business good for the time of year, and the tendency of prices is decidedly upward.

As stated last week, a considerable advance in the prices of Files is confidently announced to take effect at an early date.

Boiler Tubes, and Gas, Steam, and Water Pipes generally, are expected to advance, and preparations are making for a good, steady run of business at new rates after the first of the year.

Large quantities of the Demas Scroll Saw and Lathe, and the Holly Scroll Saws, are being sold, and this market is cleaned out on these goods.

Wm. Cooke, 6 Cortlandt St., New York, has taken the agency for the Crosby Steam Gauge, Pop Valve, and Pyrometer.

It is rumored that the prices of the Root Foundry and Blacksmith Blowers are to be advanced very soon.

Iron Review.

NEW YORK, Jan. 1, 1880.

The sales during December have been greater than for years, notwithstanding it is usually a dull month, and those best informed are now convinced that the advance in prices of Iron and Steel is to continue, and that there is no reaction in the near future, especially on to-day's quotations. The mills generally seem to have orders on their books for their possible products, some of them up to July next. The temporary reaction in old material is succeeded by a decided advance.

Pierson & Co., 24 Broadway, New York, furnish us the following quotations out of store, under date of Jan. 1, 1880. Boiler Makers' supplies: Tank Iron, 4½c.; C. No. 1 Boiler Plate, 4¾c.; C. H. No. 1 ditto, 5c.; Best Flange ditto, 6c.; Boiler Rivets, 5 to 6c.

Other Iron Supplies:

No. IX Pig, $30 to $31 per ton; Iron Rails, $50 to $60, according to weight; Old Rails $34 to $35; Fish Plates, 3¾c. per lb.; Railway Spikes, 3¾c.; Bolts and Nuts, 4½c.; Common Bar Iron, 3 2-10c., basis from store; Refined, 3½c., basis; Ulster, 4 2-10c., basis; Machinery Steel, 7c.; Best Tool Steel, 13c.; Norway Bar Iron, 6c.; Norway Shapes, 6½c.; Nail Rods, 6½c.; Sheet Iron, 4½c., basis; Angle Iron, 4c.; Tee Iron, 4½c; Band Iron, 4c.; Hoop Iron, 4 3-10c.; Horse Shoe Iron, 4c.; Hot Polished Shafting in lengths, 2 ft. and longer, 7 to 8c., according to size; Small Black Rivets 40% off in papers, 25% off in bulk.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling slip, New York, furnish us the following, under date of Dec. 31st, 1879:

The Metal Market is feverish at close of the year. A general feeling that prices may advance pervades the dealers and consumers, and the former are disinclined for business.

London quotes Straits Tin, £91; shot market only nominal; Banca, 24½c.; Malacca and Straits, 21c.; Billiton, 20¾c.; English "L. and F.," 21c.; Pig Lead firm at 6c.; Antimony, 17c. to 20c., according to brand; Ingot Copper, 21¾c. on spot, 22⅛c. futures; Spelter firmer. Domestic 6¼c. for Foreign, 6½c. Nickel, $1.25; No. 1 Solder, 11c.; "Half-and-half," 13c.

Situations Wanted—Help Wanted.

We will publish notices suitable for the above headings, applying to any of the machinery trades, and not to exceed four lines each (32 words), at the nominal rate of twenty-five cents for each insertion.

Manufacturers requiring the service of a Mechanical Engineer and Draughtsman, who can take the lead in designing and constructing first-class Steam Engines and Mill work, will please address A. P., AMERICAN MACHINIST, 96 Fulton Street, New York.

Wanted a situation by a competent Mech. Eng. and draughtsman as Supt. of Machine Shop or draughtsman, address A. E. W. care American Machinist, 96 Fulton Street, New York.

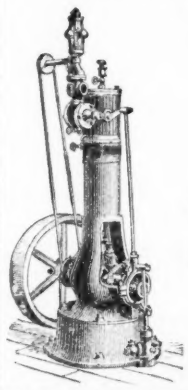
A practical mechanic, having seven years' experience in designing and constructing first-class machinery, wants a place. Good references for ability and faithfulness. Address, WILLIAM A. LORENZ, 363 Macon Street, Brooklyn, N. Y.

MACHINE
DRAWING COPIES
TEN CENTS EACH.
Send for List of Plates, now ready, and Catalogue of Books for Practical Engineers.
E. & F. N. Spon, 446 Broome St., N. Y.

Scientific Books.
Send 10c. for new Catalogue, 1879, to
D. VAN NOSTRAND,
23 Murray & 27 Warren Sts.,
NEW YORK.

FOR SALE.
A new and very strong Horizontal Steam Engine, with plain slide valve; cylinder 20″ x 48″ stroke. Can be seen in Brooklyn, N. Y.
For further information, address
T. P. Pemberton, 249 Duffield St., Brooklyn, N. Y.

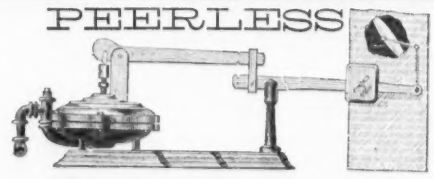
INDICATOR WANTED.
Address, Indicator, Office American Machinist, 96 Fulton Street, New York.

Vertical and Yacht Engines.

The Rowland
Vertical Engine.
LARGE WEARING SURFACES.
Simple in Construction.
Reasonable in Price.
Send for Circular.
F. C. & A. E. ROWLAND, Engineers,
NEW HAVEN, CONNECTICUT.

FOR SALE.
Three Boilers 24 ft. long, 6 ft. diameter, return drop flue, 80 horse-power, A1 make and condition. $1,500 each. Address, E. 167 Church St., New York.

RICHARD DUDGEON,
24 Columbia Street.
NEW YORK,
Maker and Patentee of
IMPROVED HYDRAULIC JACKS,

Punches, and Roller Tube Expanders,
AND
DIRECT ACTING
Steam Hammers.
Communications by letter will receive prompt attention.
Jacks for Pressing on Car Wheels or Crank Pins made to order.

Illustrated Catalogue sent on Application.
PEERLESS

Price, $38.50.
PATENT AUTOMATIC DAMPER REGULATOR!
Superior in every respect to any other Damper Regulator. Controls steam pressure within *one pound*. Fully opens or closes on less than *two pounds'* variation of pressure. Governs *high* or *low* steam from *one* to *one hundred* pounds' pressure, or higher if desired. Regulates the draft to the highest possible degree of *economy*, and effects *twice the saving* of any other Regulator. *Wherever steady power or regularity of speed is required, these Machines are indispensable. They will* REPAY COST *and over* 100 PER CENT. MORE EACH YEAR *in economy of fuel.* 30 days' Trial allowed before paying. Machine can be Returned if not Satisfactory.
13 & 15 Park Row, NEW YORK. } AMERICAN STEAM APPLIANCE CO. Sole Manufacturers. { 28 School Street, BOSTON, MASS.

W. H. HOFFMAN, M. E.,
PASSAIC, New Jersey.
Designer and Constructor of
Hawser and Rope Machinery
Working Drawings of Engines, Boilers, Machinists' and Boiler Makers' Tools.

NICHOLSON FILE CO.

SOLE MANUFACTURERS OF

FILES AND RASPS

HAVING THE INCREMENT CUT.

Also, FILERS' TOOLS and SPECIALTIES.

"Nicholson File Co's" Files and Rasps.
"Double Ender" Saw Files.
"Slim" Saw Files.
"Racer" Horse Rasps.
Handled Rifflers.
Machinists' Scrapers.
File Brushes, File Cards.
Surface File Holders,
Vise File Holders.
Stub Files and Holders.
Improved Butchers' Steels.

Manufactory and Offices at PROVIDENCE, R. I., U. S. A.

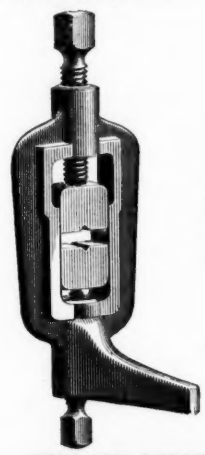
C. W. LeCOUNT,

SOUTH NORWALK, CONNECTICUT,

Manufacturer of

LeCount's Die Dogs,

Have a Steel Frame, with two screws, so as to throw the center of Die the same distance from tail of Dog on a small piece as on a large. The Dies are hardened, and a good job with Hardened Steel Screws. Extra Dies can easily be fitted to suit any special work, or will be furnished as below:



PRICES.

	EXTRA DIES.	OPENS.
No. 1,.....$1.25	25c.	¼ Inch.
" 2,..... 1.60	37c.	¾ "
" 3,..... 2.00	50c.	1 "
" 0, Amateur or for f't lathes 1.25	37c.	¾ "

When ordering Extra Dies please state which you require, the V or Tongued.

SEND FOR DESCRIPTIVE CIRCULAR.

GEO. C. TRACY & CO

Counselors at Patent Law

EUCLID AVE. BLOCK,

CLEVELAND, O.

Before doing anything in regard to Patents, send for our 140 page book, "ALL ABOUT PATENTS," mailed free.

THE CROWNING CULMINATION!

ENGINEERS, MECHANICS, Mill Owners, Miners, Merchants, &c., will find in "Moore's Universal Assistant & Complete Mechanic," a work containing 1016 pages, 500 Engravings, 461 Tables, and over 1,000,000 Industrial Facts, Calculations, Processes, Secrets, Rules, &c., of rare utility in 200 Trades. A $5 book free by mail for $2.50, worth its weight in gold to any Mechanic, Farmer, or Business Man. *Agents Wanted.* One Agent reports 41 sales in 2 days, another 29 sales in ¾ day; another 27 sales in 2 hours. For ill. Pamphlet send stamp to R. Moore, No. 20 Cooper Inst., N. Y.

Machinists' Supplies,

CHAMPLIN & SPENCER,

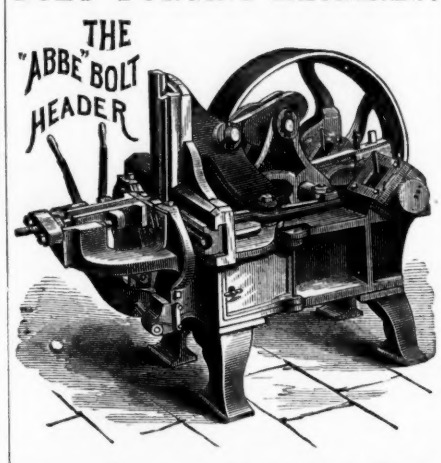
154 E. Lake Street,

CHICAGO, Ill.

Sole Agents for the Tanite Co.'s Solid Emery Wheels, Grinding Machinery, &c.

Also, agents for Shepard's Screw Cutting Lathes Dealers in Morse Twist Drill Co's Goods and small tools for all workers in iron or wood. Send for Catalogue.

BOLT FORGING MACHINES.



Power Hammers, Machinists', Blacksmiths' Tools and Wood-Working Machinery a Specialty.

S. C. FORSAITH & CO.,

MANCHESTER, N. H.

TWISS

Vertical Engine.

For all light, quick work. Size, 2 to 20 horse power. Also,

Special Yacht Engines

And the Twiss Patent Automatic Engine.

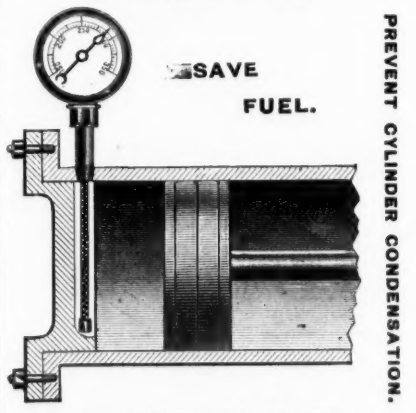
Manuf'd by NELSON W. TWISS,

NEW HAVEN, CONN.

STEAM ENGINE ECONOMY.

The DIXWELL IMPROVEMENTS

FOR WORKING ENGINES WITH SUPERHEATED STEAM.



APPLICABLE TO ANY ENGINE.

GEO. H. BARRUS, Agent,

Office, 553 Shawmut Avenue, - BOSTON.

On exhibition at the American Institute Fair with the Buckeye Engine. Estimates furnished on application. Address, during the Fair, 206 West 53d Street, New York.

HALL'S PATENT

DOUBLE COMPOUND LEVER CUTTING NIPPERS.

MACHINISTS'

SUPPLIES.

Price $1.25.

Sent by mail for 6 cents additional.

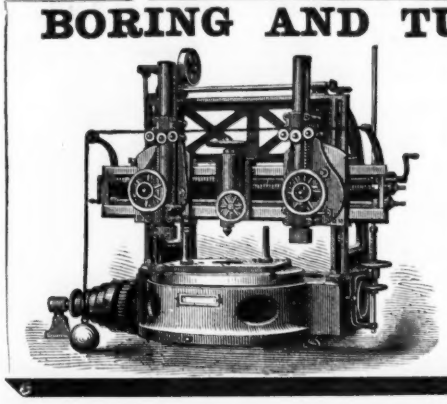
Every pair warranted.

Of the many Cutting Nippers heretofore placed on the market, not one has supplied either of the two great needs long felt by all who use them, viz.: 1st. Increased power without a clumsy and expensive increase of size. 2d. That the construction of the Nipper should be such that any damage to the cutting jaw or handle, from wear or accident, could be repaired.

All orders should be addressed to

PETER A. FRASSE & CO., Sole Agents, 95 Fulton Street, New York.

BORING AND TURNING MILLS.



All Sizes: 4, 5, 6, 8, 10, and 12 feet Swings.

PATENTED IMPROVEMENTS.

New Patterns.

MACHINISTS' TOOLS,

The Latest and Best, at very moderate prices.

NILES TOOL WORKS,
HAMILTON, OHIO.

BRADLEY'S CUSHIONED HELVE HAMMER.

Awarded first premium, Silver Medal at American Institute Fair, 1873, Cincinnati Industrial Exposition, 1874, and the Diploma of Honor and Grand Medal of Merit at the Centennial Exhibition, in 1876,

Being the highest award given any goods of their class in America or Europe.

IT HAS MORE GOOD POINTS, LESS COMPLICATION
MORE ADAPTABILITY, LARGER CAPACITY,
DOES MORE AND BETTER WORK, TAKES LESS POWER
COSTS LESS FOR REPAIRS.

THAN ANY HAMMER IN THE WORLD.

Guaranteed as represented. (Established 1832.)

Branch Office, 22 to 24 & 26 So. Canal Street, CHICAGO, ILL. } BRADLEY & COMPANY, Syracuse, N. Y.

TOOL DEPOT: CHUCKS, VISES, FILES, EMERY GRINDERS, EMERY WHEELS, WIRE STEEL, BRASS, TAPS, DIES, MACHINE, SET & CAP SCREWS, GEAR WHEELS, LATHES SHAPERS, DRILLS, SCROLL SAWS & SMALL TOOLS FOR ALL BRANCHES OF TRADE. SEND FOR CATALOGUE & STATE WHAT KIND OF TOOLS YOU REQUIRE.

TALLMAN & McFADDEN. PHILADELPHIA.

A. J. WILKINSON & CO.

186 & 188 Washington Street,

BOSTON, MASS.

Machinists' Tools & Supplies,

CUT BRASS GEARS.

CATALOGUES FREE.

MACHINISTS'
AND
FOUNDRY SUPPLIES.

Machinists' Tools, Drills, and Taps and Dies. Also, Belting and Steam Packing of all kinds, and a general assortment of supplies for

FACTORIES AND MILLS.

T. B. BICKERTON & CO.

No. 12 South Fourth Street,

PHILADELPHIA, PA.

L. B. EATON,

TOOL STORE,

No. 11 N. 6th St., Philadelphia.

SCROLL SAWS!! SCROLL SAWS!! $3, $5, $8, $11, $13, $15, $21, $22 50. Rogers, Empire, Victor Lester. Dexter, Challenge, Fleetwood.

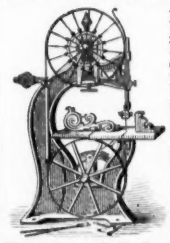
TOOL CHESTS!! TOOL CHESTS!! from 75c. to $10.00, containing from 18 to 61 Tools. Carvers, Gravers.

WOOD WORKING MACHINERY.

J. A. FAY & CO.,

BUILDERS OF

IMPROVED MACHINERY FOR WOOD CUTTING,



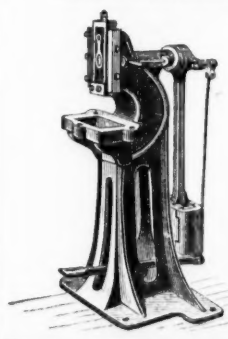
Numbering some 300 different Machines—Planing and Matching Machines, Surface Planing Machines, Molding and Tenoning Machines, Mortising and Boring Machines, Carving and Dovetailing Machines, Shafting and Friezing Machines, Horizontal and Vertical Boring Machines.

Improved Variety & Universal WOOD WORKERS.

Band, Scroll, Ripping and Cutting-off Saws, Band and Circular Resawing Machines, Spoke and Wheel Machinery, Shafting, Hangers and Pulleys, etc., etc. Original in design, simple in construction, perfect in workmanship, saves labor, economizes lumber, and its productions are of the highest standard of excellence. *Send for Circulars and Prices.*

J. A. FAY & CO., Cincinnati, Ohio, U.S.A.

ASTONISHING POWER in FOOT and HAND PRESSES.



Punching, by foot, *3-4* hole in *5-16* iron 6 inches from edge.

Smaller sizes punch, by foot, *3-8* x *1-4*, and *1* inch by *1-8*, as rapidly as by power presses, at one-half the cost.

Our largest hand machines punch *1* inch hole in *3-8* iron, and shear bar *3-4* x *2* inches at a cut, any length, one man at the lever.

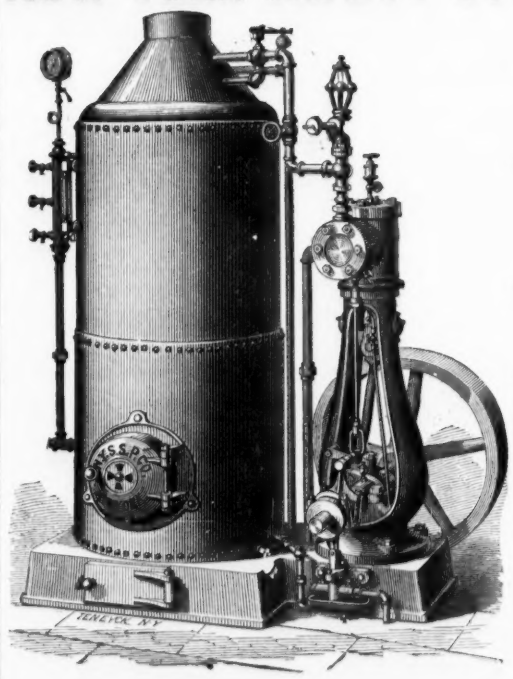
Highest prize, *The Grand Medal of Progress*, has just been awarded us at the American Institute Exhibition.

Our presses can also be run by steam power.

PEERLESS PUNCH and SHEAR CO.,

52 Dey Street, New York City.

NEW YORK SAFETY STEAM POWER CO.



30 Cortlandt Street,

New York City.

SPECIALTY,

VERTICAL STEAM ENGINES.

OVER 800 IN USE.

Twenty Different Sizes, 2 to 120 H. P.

With or without Boilers.

Many of our Engines have been at work for ten years, giving utmost satisfaction, and having cost little or nothing for repairs.

Rated Power and Surplus Strength.
Accurate Speed and Smooth Running.
Freedom from Breakage.
Reliability, Durability, and General Satisfaction Guaranteed.

We are now quoting lower Prices than ever before.

SEND FOR NEW PRICE LIST.

The E. HORTON & SON CO.

WINDSOR LOCKS, CONN.

MANUFACTURERS OF

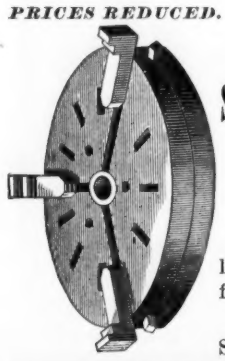
THE HORTON LATHE CHUCK

AND THE

SWEETLAND IMPROVED HORTON CHUCK,

Independent, Universal and Eccentric Combination.

PRICES REDUCED.



April 1st, 1879.

From this date a discount of 30 per cent. will be made from the list price of The Horton Lathe Chuck, and a discount of 15 per cent. from the list price of the Sweetland Improved Horton Chuck.

Soliciting your orders, we are, respectfully yours,

Send for Price List. THE E. HORTON & SON CO.

H. PRENTISS AND COMPANY

Manufacturers of PATENT RELIEVED

Machinists', Blacksmiths' and Gas Fitters'

Taps; Dies, Reamers and Screw Plates, &c., &c.

DEALERS IN MACHINISTS' SUPPLIES.

No. 14 DEY STREET, - NEW YORK.

Address P. O. Box 2187. **PIERSON & CO.** Office 24 Broadway, N.Y

ESTABLISHED 1790.

IMPORTERS AND DEALERS IN

IRON and STEEL of every Description.

Warehouse, 24 & 26 Broadway, and 77 & 79 New Street.

PRICE LISTS FURNISHED ON APPLICATION.

A. F. PRENTICE & CO.

Manufacturers of

Light Machinists' Tools.

Improved Upright Drills, with Lever Feed and Wheel Feed with Quick Return Motion.

Hand and Foot Power Lathes.

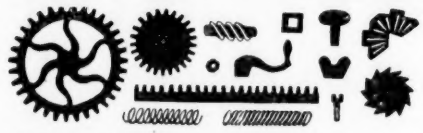
SLIDE RESTS.

Special Machinery and Machine Jobbing.

FOOT POWER LATHES A SPECIALTY.

54 Hermon Street,

WORCESTER, MASS.



Small Tools of all kinds: GEAR WHEELS, parts of MODELS, and materials of all kinds. Catalogues free. GOODNOW & WIGHTMAN, 176 Wash'ton St., Boston, Mass.

E. E. GARVIN & CO.

Manufacturers of

Milling Machines, Drill Presses,

No. 4 Milling Machine.

Hand Lathes, Tapping Machines, Cutter Grinders and Wood Planers. Milling Cutters, all shapes and sizes. Gear Cutting and Milling in all its branches.

139-143 CENTRE ST.

Cornell's B'ld'g

NEW YORK.

☞ Send for illustrated Catalogue.

The Hendey Machine Co.

Wolcottville, Conn., U. S. A.

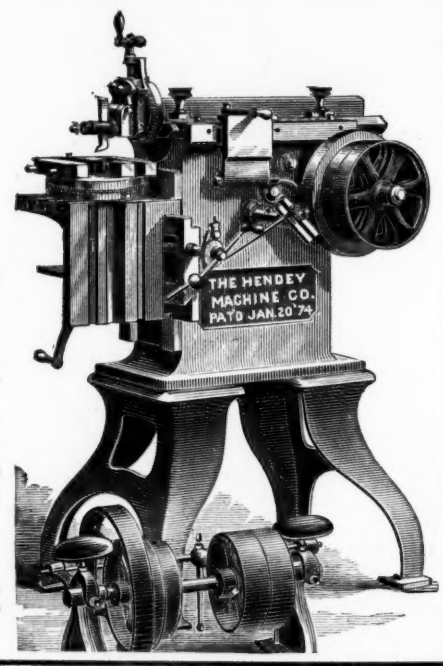
MANUFACTURERS OF THE

MANVILLE PATENT IRON

Planers and Shapers.

24 in. Shapers, 15 in. Shapers, 5 ft. x 24 in. Planers, 3½ ft x 16 in. Planers, 24 in. Amateur's Hand Planers, with Chuck and Centers, 3 ft. x 8 in. Fine Engine Lathes, 5 ft. x 12 in. Hollow Steel Spindle Hand Lathes, Brass and Wire Slitters, Spring Chuck and Common Clock Lathes.

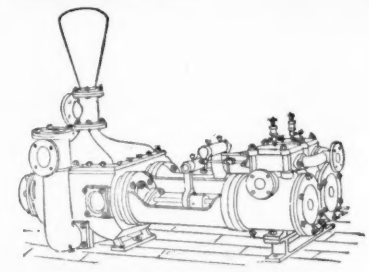
☞ Send for Catalogue giving description of Tools, with names and opinions of users, and mention where you saw this.



W. H. ODELL, ENGINES INDICATED, POWER MEASURED.

BOX 274, YONKERS, N. Y.

STEAM PUMPS.



HENRY R. WORTHINGTON,

239 Broadway, N. Y. 83 Water Street, Boston.

THE WORTHINGTON DUPLEX PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water Works Stations.

STEAM PUMPS for all purposes—Duplex and Single Cylinder.

PRICE LIST ISSUED JAN. 1, 1879, WITH A REDUCTION EXCEEDING 30 PER CENT.

WATER METERS. OIL METERS.

Newell's Patent Universal Grinder.

IMPORTANT TO MILLERS, MINERS AND MANUFACTURERS.

This Grinder is offered to the public as a machine which has no equal for grinding grain or pulverizing quartz, phosphates, bone, cement, oyster shells, scraps, glue, fire clay, and other articles of similar nature. It is unrivaled in the amount of work it will do in any given time and in the economy of power used. It is a point of great merit that our mill delivers a perfectly *GRANULATED* article. In grinding grain the meal *IS NOT HEATED*, and consequently may be bagged at the delivery spout with no danger of fermentation, and without the loss of weight incidental to the product when heated in grinding. It is estimated that the usual shrinkage is sufficient to cover the entire expense of grinding by this mill. We have ground, bolted for fine feed, through 13 mesh, weighed and bagged up ***six thousand five hundred (6500) pounds of corn per hour*** with not more than 15-horse power. It is compact, portable and not expensive. A cordial invitation is extended to all parties to call and see the machine at work at

Foot West 19th Street, New York City.

NEWELL & CHAPIN.

TRADE GODDARD MARK

THE

Goddard Emery Wheel,

E. A. GODDARD,

Gen. Sales Agent.

ALSO AGENT FOR

AMERICAN TWIST DRILL CO'S

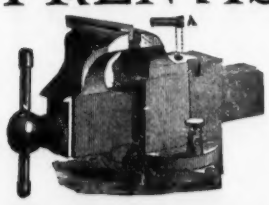
Emery Grinders.

DEALER IN

MACHINISTS' SUPPLIES.

Warerooms, 176 FULTON STREET, NEW YORK.

PRENTISS PATENT VISES,



ADJUSTABLE JAWS,

Stationary and Patent Swivel Bottoms,

Adapted to all kinds of Vise work.

HALL M'F'G CO., 23 DEY ST., NEW YORK.

SEND FOR CIRCULAR.

Stoves and Fire-Place Heaters,

COMBINING

THREE THINGS IN ONE APPARATUS:

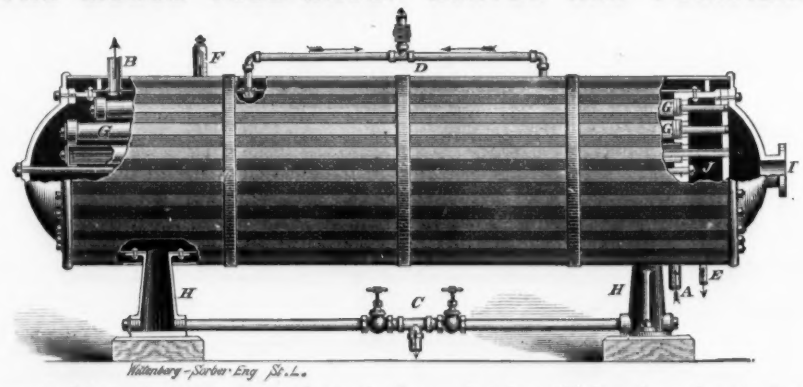
Open Fire, Close Stove, Warm Air Furnace.

Send for descriptive catalogue and testimonials from highest scientific and practical authorities in this country.

OPEN STOVE VENTILATING CO.

78 Beekman St., New York.

THE MORSE FEED-WATER HEATER AND PURIFIER.



Guaranteed to be the most perfect device in the market for utilizing the exhaust of steam engines. For further particulars, address

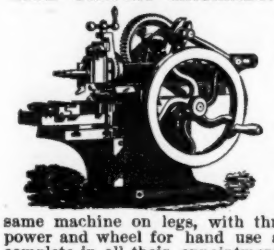
E. L. MORSE, Mechanical Engineer, 313 Olive Street, St. Louis, Mo., or J. F. WANGLER, St. Louis Boiler Works.

Boynton & Plummer,

WORCESTER, Mass.

Manufacturers of

HAND SHAPING MACHINES.



These machines have a stroke of six inches and may be readily adjusted to work any less distance. Length of traverse eight inches. Vertical adjustment of table five inches. The surface of hand wheel is made flat so as to carry a belt when wanted for power. The same machine on legs, with three speed cones for power and wheel for hand use also, making them complete in all their appointments, and a desirable tool for Model Makers, Die Sinkers, Railroad Shops and all other shops where machine work is done.

JOHN ADT,

20, 22, 24 and 26 Artisan St., New Haven, Ct., U. S.

Automatic Machines,

For Straightening and Cutting Wire of all Sizes to any Length.

Automatic Machines for cutting and forming wire in various shapes. Send for circulars.

STEAM AND HYDRAULIC ENGINEERING.

FRANK H. POND, M.E.

CORRESPONDENCE SOLICITED. ST. LOUIS, Mo.

P. BLAISDELL & CO.

MANUFACTURERS OF

Machinists' Tools,

Worcester, MASS.

IMPROVED

Hollow Spindle Engine Lathe.

Length of Bed, 42 in. Swing, 11 in. Turns 22 in. between centers. Three Cone Spindles and Wheels. Weight 450 lbs.

FRASSE & CO.,
MACHINISTS' SUPPLIES,
P. O. BOX 4627,
62 Chatham Street, New York.

PATTERN AND BRAND LETTERS.

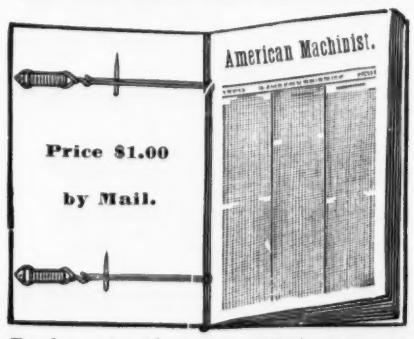
PRICES REDUCED.

VANDERBURGH, WELLS & CO.

Printers' and Engravers' Warehouse,
Corner Fulton and Dutch Sts.,
NEW YORK:

Monitor Binders

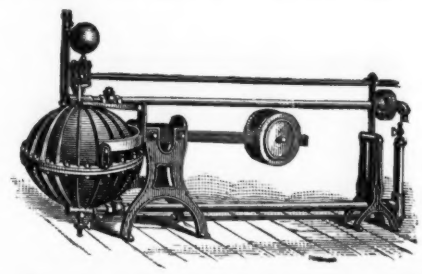
FOR THE AMERICAN MACHINIST.



Readers should preserve their papers in neat, stiff covers like the above. The name American Machinist is stamped on each in gilt letters. Address

American Machinist Publishing Co.,
96 Fulton Street, New York.

THE ALBANY STEAM TRAP.



This Trap automatically drains the water of condensation from HEATING COILS, and returns the same to the Boiler, whether the coils are *above or below* the water level in Boiler, thus doing away with pumps and other mechanical devices for such purposes.

Apply to

Albany Steam Trap Co.

ALBANY, N. Y.

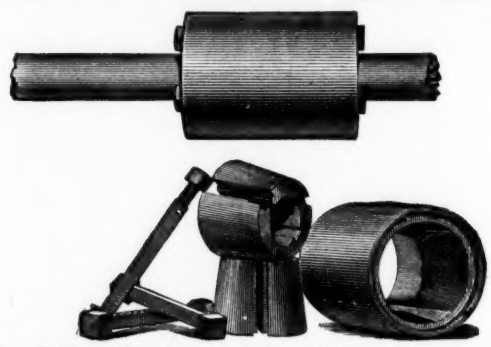
ESTABLISHED 1848.

WILLIAM SELLERS & CO.

PHILADELPHIA.

Machine & Railway Shop Equipments

Shafts,
Couplings,
Hangers,
Pulleys,
Mill Gearing,
Etc.



Lathes,
Planers,
Drills,
Shapers.
Bolt Cutters,
Etc.

Railway Turntables & Pivot Bridges. Gifford Injectors, Sellers' Improvements

NEW PATTERNS. SIMPLE, EFFECTIVE

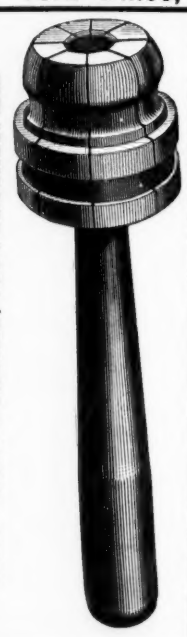
New York Office, 79 Liberty Street.

THOS. PROSSER & SON,

15 Gold St., NEW YORK.

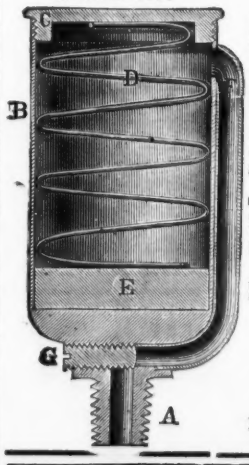
"Prosser" Boiler Tube Expanders

STEEL SCREW PUNCHES, TUBE BRUSHES, &c.



Loose Pulley Lubricator.

Sectional View.



The only reliable automatic Loose Pulley Oiler in the World.

Saves Oil, Belting, Machinery, Time, soiling of Fabrics, &c., &c. Will run from one to three months with once filling. Gives general satisfaction.

For illustrated description see April issue of American Machinist, 1879, or send for circular. Address

Loose Pulley Lubricator Mf'g Co.

P. O. Box 1030.

MIDDLETOWN, CT.

ENGRAVING ON WOOD

D. H. TUTTLE 5 BEEKMAN ST. N.Y.

Mechanical work a Specialty.

WONDERFUL PUNCHING.

D. L. KENNEDY'S

Spiral Shearing Punch

THE

DRILL

AND REVOLVING CUTTER

SUPERSEDED,

AND THE WORK

2½ TONS PER SQUARE INCH

STRONGER than with the FLAT PUNCH.

Can be used in any Punching Machine, by license from the patentee.

D. L. KENNEDY,
10 Cortlandt St., New York.

CAUTION.—Infringements will be rigorously prosecuted.

The Goulds Manufacturing Co.

Manufacturers of all kinds of

Force and Lift **PUMPS**

For Cisterns, Wells, Railroads, Steamboats, Windmills, etc.

FIRE ENGINES, Hydraulic Rams, AMALGAMBELLS

For Churches, Schools, and Plantations.

Corn-Sheilers, Sinks, etc. Pumps and Materials for Driven Wells a specialty. *Satisfaction guaranteed.* Catalogues furnished upon application.

INQUIRE FOR GOULDS PUMPS

FACTORY, SENECA FALLS, N. Y.
WAREHOUSE, 15 PARK PLACE, NEW YORK CITY.

DOWNER'S

Anti-Incrustation Liquid

FOR THE PREVENTION AND REMOVAL OF SCALE IN STEAM BOILERS,

Is a Chemically Scientific Preparation,

SAFE, EFFECTIVE AND ECONOMICAL.

Used in new or clean boilers scale cannot form, as scale-producing constituents are neutralized.

IN BARRELS AND HALF BARRELS.

Circulars on application.

A. H. DOWNER,
(Proprietor and Sole Manuf'r.)
17 PECK SLIP, N. Y.

NOTABLE ARTICLES.

Original articles by *thirty-one* of the best writers on mechanical subjects, were contributed to the AMERICAN MACHINIST, as below. Copies containing these articles can be ordered through any newsdealer at ***6 cents*** each.

Prof. John E. Sweet.
Defects in Building Engine Lathes. June 28, 1879.
A Novel Centering Device. July 19, 1879.
Engine Construction. August 9, 1879.
Prevention of Injury from Machinery. Sept. 13, 1879.
Bits of Experience. Oct. 11, Nov. 15 and 29, 1879.

Chas. E. Emery, Ph.D.
Marine Governors. October 18, 1879.

Park Benjamin, Ph. D.
Safes and Safe Breaking. Nov. 1, 1879.
Concerning Trade Literature. Nov. 29, 1879.

John J. Grant M. E.
Standard Gauges and Tools for Accurate Measurements. May, 1878.
The Lathe and its Uses. August, 1878.
To prepare a Shaft Properly for Turning. Oct., 1878.
To Turn a Shaft properly. December, 1878.
To Bore and Turn a Pulley properly. July 5, 1879.

John W. Hill, C. E.
Strength of Steam Boilers. July, 1878.
The Properties of Water. August, 1878.
Composition of Fuel. September, 1878.

Charles T. Porter.
Advantages of High Speed Engines. August 9, 16, 23, Sept. 27, Oct. 11, 18. Nov. 15, 29, Dec. 20, 1879.

John W. Nystrom, C. E.
Horse-Power of Steam Boilers. Nov. 22, 1879.

"Chordal."
Extracts from Chordal's Letters, in every issue since July, 1878, except March, August 30, Sept. 27, Dec. 6, 1879, and Jan. 10, 1880.
Balancing Pulleys. August, 1878.
Scraped Surfaces. August 30, 1879.
A Mechanical Time Keeper. July 5, 1879.

L. F. Lyne, M. E.
Practical Method of Setting the Valves of a Locomotive. November, 1878.
Boring Locomotive Cylinders. December, 1878.
Faulty Construction of Locomotive Boilers, Management, &c. January, 1879.
Improvement in Slide Rests. May, 1879.
Use and Abuse of the Engine Lathe. June 28 and August 23, 1879.
Use of the Ratchet Drill. July 12, 1879.
Oil Stones and their Uses. August 9, 1879.
What Constitutes a Good Lathe. August 30, 1879.
Use of Lubricants. September 20, Nov. 1, 1879.

Wm. Lee Church, C. E.
Piston Speed of Engines. September, 1878.
Engineering Popularized. Jan., Feb., March, April, May, June 28, July 19, Aug. 16, 1879.
Talks. Nov. 22, Dec. 20, 1879, Jan. 10, 1880.

Charles A. Hague.
Engine Duty and Indicator Cards. April, 1879.
Steam Engineering. June 28, Aug. 2, Sept. 20, 1879.
Piston Speed and Steam Compression. Oct. 4, 1879.

Thos. Hagerty, M. E.
Grinding and Polishing Metal Surfaces by Hand. December, 1878.

Wm. H. Hoffman, M. E.
Engine Proportion and Construction. July 26, August 2, 16, 23, 30, September 13, 20, 27, and October 4, 11 and 18, 1879.
Boiler Proportion and Construction. October 25, Nov. 8, 15, 22, 29, Dec. 6, 13, 20, 27, 1879, Jan. 3 and 10, 1880.

W. H. Odell, M. E.
Calculated *vs.* Actual Engine Duty. January, 1879.

Samuel S. Webber, C. E.
Varieties of Friction. April, 1879.
Turbine Water Wheels. Nov. 29, Dec. 6 and 20, 1879.

Wm. J. Williams.
Dry Plumbago *vs.* Tallow and Oils in Steam Cylinders. December, 1878.
The Injector and its Economy in Raising Water. March and July 5, 1879.
Evaporation of Water in Steam Boilers. August 9, 1879.
Steam Boiler Explosions. October 18, 1879.

Joshua Rose, M. E.
Lathe Dogs and Drivers. Nov. 15, 1879.

H. L. Stellwagen, M. E.
Putting Shafts in Screw Vessels. Nov. 29, 1879.

Wm. Main.
Method of Grinding a Perfect Sphere on a Lathe. October 25, 1879.
An Easy Method of Calculating the Loss in Long Steam Connections. Dec, 27, 1879.

"V. Hook."
Remodeling Valve Motions. August 2, 1879.
Setting Up Steam Engines. August 16, 1879.
Casting of Small Steam Cylinders. Aug. 30, 1879.
Moulding Raised Pulleys. October 11, 1879.
Putting Up Shafting. October 25, 1879.
Virtual Velocities. Nov. 1, 1879.
Foundry Cupolas. Nov. 15, 1879.
Railroading Emergencies. Nov. 15, 1879.

F. F. Hemenway, M. E.
Boiler and Cylinder Pressure. August 23, 1879.
Automatic *vs.* Fixed Cut-offs. August 30, 1879.
Engine Economy. Sept. 27, Nov. 8, Dec. 6, 1879.

R. Grimshaw, Ph. D.
Concerning Steam Fire Engines. July 12, 1879.

E. H. Robbins.
Steam Condensation and Pressure. Sept. 27, 1879.
What is the Power of my Engine? Oct. 18, 1879.

J. H. Dunbar.
Some Engine Tests. October 25, 1879.

F. G. Woodward.
How to Adjust Shafting. November 1, 1879.
A Substitute for an Equilibrium Slide Valve. Nov. 8, 1879.
Machine Finish. Nov. 29, 1879.
A Simple Reverse Motion. Jan. 3, 1880.

D. F. Nisbet.
Re-compression as a Factor in Economy. Nov. 1, 1879.

John Fish, M. E.
Compressed Air. Nov. 22, 29, Dec. 6, 13 and 27, 1879.

W. Barnet LeVan.
Mechanical Terms. Dec. 6, 1879.

George Guntz, M. E.
How to use a Soldering Iron. Dec. 13, 1879.

Geo. H. Benjamin, M. D.
Machine Shop Surgery. Jan. 3, 1880.

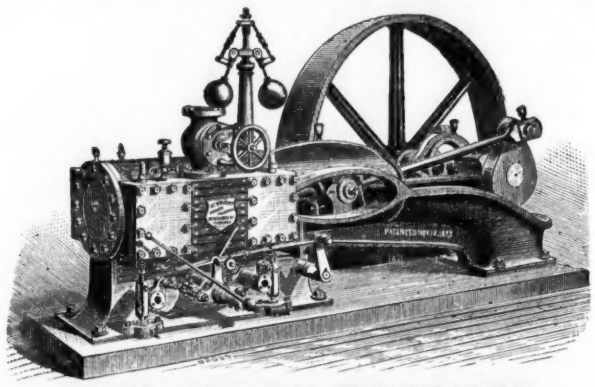
T. P. Pemberton.
Practical Draughting. Jan. 3, 1880.

Patent Automatic Cut-off Steam Engine.

WM. WRIGHT,

PATENTEE AND BUILDER, NEWBURGH, N. Y,

THE MOST ECONOMICAL IN THE USE OF FUEL, THE SIMPLEST IN CONSTRUCTION, AND ALTOGETHER THE BEST CUT-OFF ENGINE IN THE MARKET.



COMPOUND ENGINES

For City Water Works; also for Manufacturing purposes, etc. (*Highest duty guaranteed.*)
MARINE AND STATIONARY ENGINES.

STEAM BOILERS AND TANKS,

LIGHT AND HEAVY FORGINGS, SHAFTING, PULLEYS, HANGERS, MILL WORK, IRON AND BRASS CASTINGS,&c.

A LARGE GENERAL ASSORTMENT OF PATTERNS ON HAND.

JARVIS PATENT FURNACE

FOR SETTING

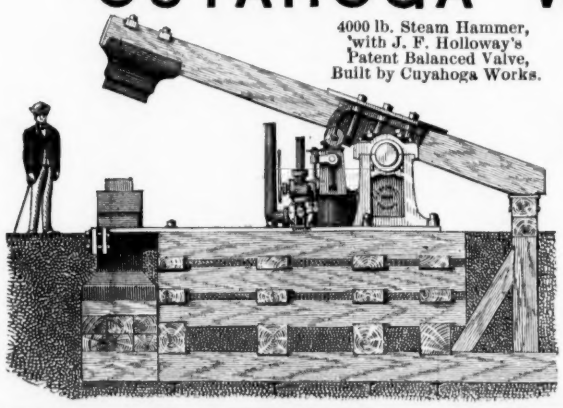
STEAM BOILERS.

Economy of Fuel, with increased capacity of Steam Power.
The same principle as the SIEMENS' PROCESS OF MAKING STEEL, utilizes the waste gases with hot air on top of the fire.
Will burn all kinds of waste fuel without a blast. including screenings, wet peat, wet hops, sawdust, log-wood chips, horse manure, &c.

A. F. UPTON, General Agent.

Also Agent for the Mahony Patent Corrugated Grates, with 50 per cent. air space.
Send for Circular. *P. O. BOX 3401, BOSTON, MASS.*

CUYAHOGA WORKS



4000 lb. Steam Hammer, with J. F. Holloway's Patent Balanced Valve, Built by Cuyahoga Works.

Manufacturers

LAND

AND

MARINE ENGINES,

BLAST FURNACE

Machinery,

STEAM

Hammers

Send for Circulars.

Cleveland, Ohio, U. S. A.

LATHE ATTACHMENTS

FOR MILLING,

Plane and Irregular Forms.

Taps and Reamers Fluted and Gears cut without removing from the lathe centers.

See American Machinist, Sept. 13 and 20.
For circular address WM. MAIN, Piermont, N. Y.

JOHN FISH, M. E.

145 Broadway, Room 33,

(Of the Pneumatic Tramway Co.) New York City.

Special attention given to Designing and Superintending the Construction of Improved Machinery.
Hoisting Engines, Air Compressors, and Pneumatic Motors a Specialty.
Working Drawings and Plans, Specifications and Estimates furnished.

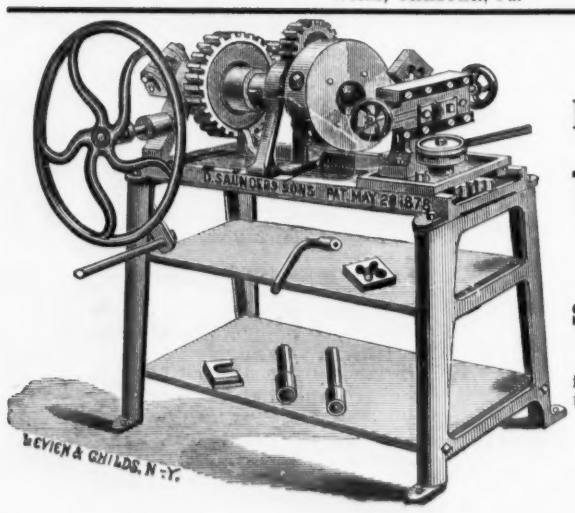
STEEL CASTINGS

FROM 1-4 TO 10,000 lbs. WEIGHT.

True to pattern, sound and solid, of unequaled strength, toughness and durability.
An invaluable substitute for forgings or cast iron requiring three-fold strength.
Gearing of all kinds, Shoes, Dies, Hammerheads, Crossheads for Locomotives, etc.
12,000 Crank Shafts of this steel now running proved superior to wrought iron.
CRANK SHAFTS, CROSSHEADS and GEARING specialties.
Circulars and Price Lists free. Address

CHESTER STEEL CASTINGS CO.

Formerly McHaffie Direct Steel Castings Co.
Works, CHESTER, Pa. 407 Library St., PHILADELPHIA.



D. SAUNDERS' SONS

New Pipe-Threading Machine

The I.X.L.

FOR HAND OR POWER.

Manufacturers of

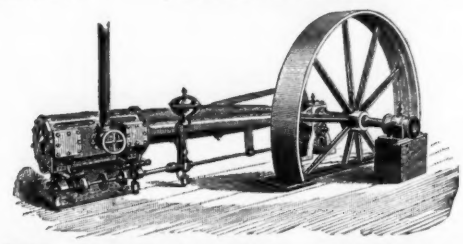
Steam & Gas Fitters' Tools.

Pipe Cutting and Threading Machines for Pipe Mill Use, &c., a Specialty.

YONKERS, N. Y.

SEND FOR CIRCULARS.

The "Brown" Automatic CUT-OFF ENGINE.



UNEXCELLED FOR WORKMANSHIP, ECONOMY & DURABILITY.

WRITE FOR PRICES AND INFORMATION.

C. H. BROWN & CO., Sole Manufacturers,
FITCHBURG, MASS.

SIZES and PRICES.

VERTICAL.

NAME.	Horse Power.	PRICE.
Mercury	10	$250
Queen	15	275
Monarch	20	325
Vulcan	30	400
HORIZONTAL		
Meteor	10	$225
Reliable	20	275
Hercules	30	375

A NEW DEPARTURE.

VERTICAL AND HORIZONTAL ENGINES AND YACHT ENGINES

OF FROM 10 TO 30 H. P.

At a Reduction of Fifty Per Cent. from Former Prices.

BEST MATERIAL. BEST WORKMANSHIP. LOWEST PRICES.

Manufactured by HEALD, SISCO & CO., Baldwinsville, N. Y.

Send for new Illustrated Circular, giving full description, and convincing testimonials, of which the following is a specimen:

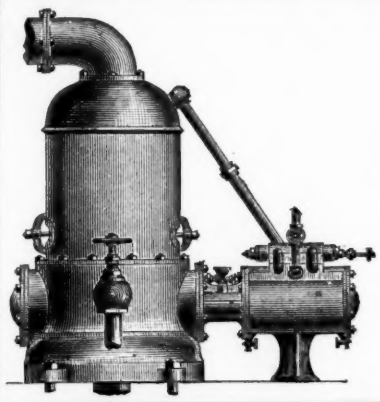
U. S. ENGINEER'S OFFICE,
PITTSBURGH, Pa., July 23, 1879.

Messrs. HEALD, SISCO & Co., Baldwinsville, N. Y.

Gentlemen:—In reply to your letter of the 19th instant, I have to say that we have had one of your "Reliable" horizontal engines at work since the middle of October, 1878, up to the present time. It has been used for driving one of your No. 10 Centrifugal Vertical Pumps, and has given us entire satisfaction. The only repairs necessary has been the replacing of the piston packing once.

Yours truly, T. A. MAHAN,
1st Lieut. Engineers.

[We desire to call particular attention to the above letter, as since it was received by us, Lieut. Mahan has confirmed his good opinion of our Engines therein expressed, by ordering two more of them.]



20 Per Cent. Saving in Fuel,
25 Per Cent. Increased Power

BY ATTACHING

HAMILTON'S INDEPENDENT AIR PUMP

AND CONDENSER

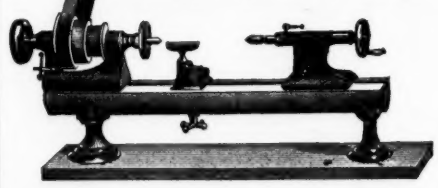
TO YOUR ENGINE.

Manufactured only by

SAWTELLE & JUDD,

HARTFORD, CONN.

American Watch Tool Co., Waltham, Mass.



MANUFACTURERS OF

MACHINERY

FOR

Watch and Clock Making,

AND

Special Tools and Machinery of all kinds.

The accompanying cut shows our No. 3, or Machinist Bench Lathe. This lathe was originally designed for the American Watch Co., and has been adopted by all American watch companies and by many clock companies of this country, and watch companies of England and Switzerland. All agree in pronouncing it the best lathe for small work ever made.

Betts Machine Co.

WILMINGTON, DEL.

Have on hand a large lot of

NEW AND SECOND HAND

Machine Tools.

WHITTIER MACHINE CO.

MANUFACTURERS OF

STEEL BOILERS,

Steam Engines and Elevators,

Boston, Mass.: Works, 1176 Tremont St.

N. Y. Office, 120 Broadway.

STEELINE.

Used for refining and tempering all kinds of Steel Tools.
Increases their durability at least five-fold.
Secures absolute safety from cracking.
Send for Circular to

BAUER & CO., 96 Greenwich Ave., N. Y.

THE

Waters' Perfect Governor,

WITH AUTOMATIC SAFETY STOP, ADJUSTABLE SPEED, SOLID COMPOSITION VALVES AND SEATS.

EVERY GOVERNOR IS WARRANTED.

WILLIAM COOKE,

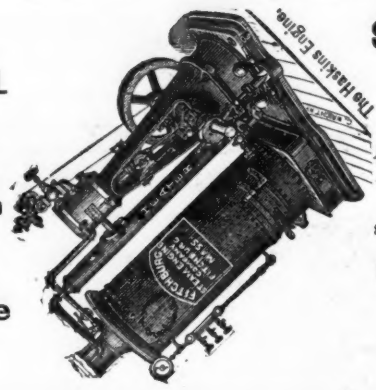
(Successor to COOKE & BEGGS),

AGENT.

6 Cortlandt Street, - New York, N. Y.

A FULL LINE ALWAYS IN STOCK.

HORIZONTAL.
VERTICAL
Automatic Cut-off
ENGINES.
Yacht Engines,
Semi-Portable Engines.



STEEL AND IRON BOILERS.

All sizes to 225 horse-power.

Send for pamphlet and say where you saw this.

FITCHBURG STEAM ENGINE CO.
Fitchburg, Mass.

THE·STOW·FLEXIBLE·SHAFT·CO·LIMITED·

As this shaft transmits power through any number of curves, its value in the railroad and general machine shop, is at once apparent. We have designed, and keep in stock, a series of special tools for use with the shaft, as:- PORTABLE DRILLS for metals; AUGER CHUCKS for wood; CLAMPS for emery and buffing wheels, etc.
CATALOGUE and PRICE LIST, on application.

500·NORTH·FIFTEENTH·ST·PHILADELPHIA·

CHUCKS

MANUFACTURED BY

A. F. CUSHMAN, HARTFORD, CONN.

—○ U. S. A. ○—

Independent 4 Jawed, from 6 in. to 24 in. in diameter. Common Lever Scroll Chucks, from 3 in. to 24 in. in diameter. Patent Geared Chucks, from 3 in. to 12 in. Common Geared Chucks, from 2 in. to 12 in. A large variety of Chucks for Amateur's Foot Lathes. Drill Chucks for all kinds of machines and purposes. Patent Geared Chucks for Hollow Spindle Cutting-off Machines. Bench and Portable Centering Chucks, and special Chucks made to order and satisfaction guaranteed. All of the above are from new patterns, with every improvement a long experience can suggest.

SEND FOR PRICE LIST.

A PRACTICAL TREATISE
ON THE
COMBUSTION OF COAL,
Including Descriptions of various Mechanical Devices, for the Economic Generation of Heat by the Combustion of Fuel, whether SOLID, LIQUID, OR GASEOUS.
BY
WILLIAM M. BARR.
1 Vol., large 8vo., illustrated.
Price, Extra Cloth, - - - - - $2.50
" Half Morocco, - - - - 3.50
Sent, postage paid, to any part of the United States upon receipt of the price. Address
JOHN BROTHERS, Publishers, Indianapolis, Ind.

A LARGE ASSORTMENT
—OF—
NEW AND SECOND-HAND
MACHINERY

STEAM ENGINE MACHINERY.
One Corliss Beam Condensing Engine, 30 in.x72 in.
One Delemater " " " 26 in.x48in.
One Beam Engine, 6 horse power, 5 in.x10 in.
Five Horizontal Engines, 9 in.x16 in.
Two " " 8 in.x12 in.
Two 10 horse Hoisting Engines.
Two 5 " Portable "
One Upright Engine, 16 in.x16 in.
One Horizontal Corliss Engine, 10 in.x24 in.
One Locomotive Boiler, 4 ft.x13 ft.
Judson's Governors, from 2 in. to 2½ in.
One Horizontal Engine, 14 in. x 36 in.
One Boiler, 15 ft. long x 5 ft. x 6 in.
One Horizontal Corliss Engine, 80 horse power.

MACHINISTS' TOOLS.
One Lathe, 28 in x20 ft.
One " 24 in.x14 ft.
One " 16 in.x7 ft.
One " 40 in.x28 ft.
One Pattern Maker's Lathe.
One Planer, 42 in.x42 in.x16 ft.
One " 42 in.x42 in.x9 ft. (Pond, maker).
One " 30 in.x30 in.x7 ft.
One " 27 in.x22 in.x4 ft.
One Slotting Machine, 36 in. stroke, 7 ft. wide.
One " " 12 in. stroke, 30 in. wide.
One Bement's Boring Machine.
One Travis' Boring Machine.
One Milling Machine.
Eighteen Drilling Machines.
One Root Blower.
Dudgeon's Punches and Jacks.
One Bogardus Mill. No. 5.
" " " " 2.
" Pair Hand Shears. Pope's Patent.
One Large Power Punch for bridge iron.
One 3000-Ton Hydraulic Press and Pump.
One Dudgeon Beam Punch.
Cotton Drawing Machine.

WOOD WORKING MACHINERY.
One Schenck Planer and Matcher.
One Patent Hub Boring Machine.
One Daniels Planer, 30 in. wide x 30 ft.
One Carriage Maker's Dressing Machine.

STEAM PUMPS.
One Knowles Special Pump, No. 7.
One Woodward Steam Pump, No. 4.
One Cameron Steam Pump, No. 2.
One Guild & Garrison Steam Pump, No. 3.
Large lot of Vises.
Lot of Belting, all sizes.
5 pair Fairbanks' Scales, weighing from 500 to 3500.

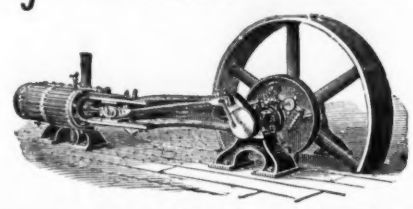
J. Gray's Machinery Depot
37 Dey Street, New York.

SECOND-HAND
Machinists' Tools.

One 23 x 48 in. **Corliss Engine.**
One Engine Lathe, 50 in. x 16 ft. Wood, Light & Co.
One Engine Lathe, 30 in. x 16 ft., Wheeler, new.
One " " 26 in. x 14 ft. " "
One " " 26 in. x 13 ft., very heavy.
One " " 22 in. x 21 ft., for shafting, Wh'ler.
Three " " 20 in. x 6 ft. Wheeler.
One " " 19 in. x 7 ft. Whitcomb.
One " " 18 in. x 8¼ ft. Wood, Light & Co.
One " " 18 in. x 7 ft. N. Y. S. Eng. Co.
One " " 16 in. x 8 ft. Wheeler, new.
Two " " 16 in. x 7 ft.
Two " " 15 in. x 6 ft. Lathe & Morse.
One " " 13 in. x 5 ft. Gould.
One " " 24 in. x12 ft Not Screw Cutting.
One " " 16 in. x 10 ft. Not Screw Cutting.
Six " " 12 in. x 4 ft. Not Screw Cutting.
One large Chucking Lathe and Chuck.
One Hand Lathe, 18 in. x 4¼ ft.
One " " 13 in. x 5 ft.
Six " " 11 in. x 4½ ft. New Spencer.
Six " " 7 in. x 2½ ft. " "
One Planer, 30 in. x 7 ft.
One " 30 in. x 6ft. Wheeler.
One " 24 in. x 4 ft. W. L. & Co.
One " 22 in. x 4 ft. Wheeler.
One " 22 in. x 5 ft. " New.
One Crank Planer, 24 in. stroke.
One 8 in. stroke Shaper. Gould.
One 8 in. " " Pratt & Whitney.
One Brown & Sharpe Universal Milling Machine.
One No. 3 Garvin Milling Machine.
Two Lincoln Pattern Milling Machines.
One 27 in. Swing Upright Drill. New Bk. Geared and Self-feed,
One 24 in. " " " P. & W. Self-feed.
One 21 in. " " " Wheeler.
One 18 in. " " " Fitchburg.
One 10 in. " " " Blaisdell.
One each No. 0 P. and W. 2 and 3 Spindle Drills.
One each No. 1 P. and W. 3 and No. 2, 4 Spindle Drills.
Three Sensitive Drills, drills to 3-16 in. hole.
One No. 1 Brown & Sharpe Screw Machine Chasing Bar.
One No. 4 Stile's Punch Press.
One No. 1 Wilder Punch Press. New.
One No. 4 " " " Geared. New.
One No. 6 " Shear. Geared.
One 10 H. P. Baxter Engine.
Seven Stephens' Vises.
Belting, Shafting and Miscellaneous Machinery.

E. P. BULLARD,
14 Dey Street, New York.

The Buckeye Automatic Cut-off Engine.



Estimates Furnished on Application.

BUCKEYE ENGINE CO.

Room 42, Coal and Iron Exchange, New York.

HILL, CLARKE & CO., - - - 36 & 38 Oliver Street, Boston.

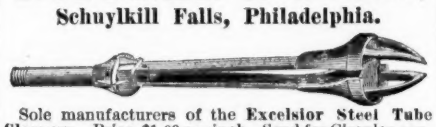
The George Place Machinery Agency

Offer for sale all the second-hand tools of the Wood & Light Machine Co., at their Works; also a number of new tools made by them at very low prices; also a large assortment of new and second-hand tools and machinery in stock. SEND FOR A LIST.

The George Place Machinery Agency,

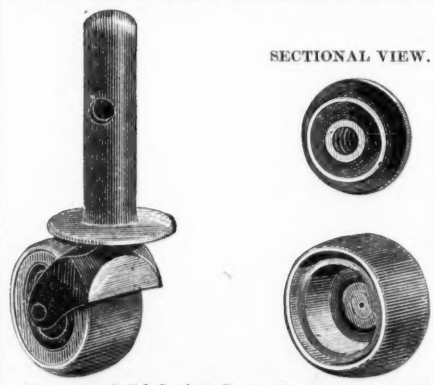
121 Chambers & 103 Reade Sts., New York.

RUFFNER & DUNN,
Schuylkill Falls, Philadelphia.



Sole manufacturers of the **Excelsior Steel Tube Cleaners.** Price, $1.00 per inch. Send for Circular containing names of users who consider it indispensable

GEORGE P. CLARK,
Manufacturer of the Patent
RUBBER CASTOR.



The only Solid Socket Castor in the market. No more noise. No more marking of inlaid floors. Save your carpets by using the Rubber Castor. Warranted perfect in action. Also one of the best non-conductors for Rheumatism. Want to be used to be appreciated. Once tried always liked.

GEORGE P. CLARK, Windsor Locks, Ct.

CHARLES MURRAY.
ENGRAVER ON WOOD.
No. 58 ANN ST.
NEW YORK.

ENGINEERS.

THE RIGHT MEN IN THE RIGHT PLACES

Having posted ourselves in the specialties of all well known Engineers and Chemists, and having made favorable contracts with many, we are prepared to supply their services.

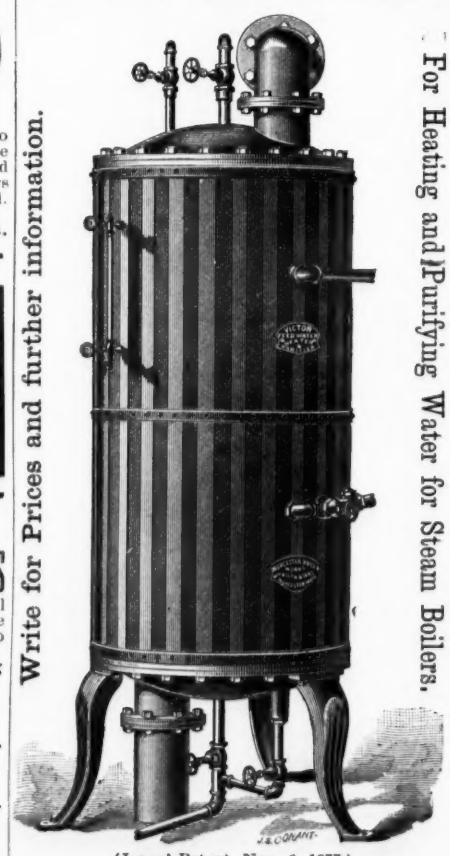
For designing, constructing and testing machinery and fitting up factories.
For Hydraulic Works.
For Bridge Building.
For Mining Work of all kinds.
For Blast Furnace Building and Metallurgical Operations.
For Sanitary Engineering.
For Surveys. For Railroads.
For Reports on New Inventions for Capitalists.
For Analyses and Assays.
For Expert Testimony in Law Suits.
For Professional Advice generally.

THE BEST TALENT AT MODERATE COST.
Park Benjamin's Scientific Expert Office,
37 Park Row, New York.

SAM. TRO. SMITH,
COUNSELLOR AT LAW,
AND
Advocate in Patent Cases.
NOTARY PUBLIC.
21 PARK ROW, - NEW YORK.

Top Floor—Take Elevator.

WORCESTER BOILER WORKS,
MANUFACTURERS OF THE
"VICTOR"
Feed-Water-Heater and Purifier.



Write for Prices and further information. For Heating and Purifying Water for Steam Boilers.

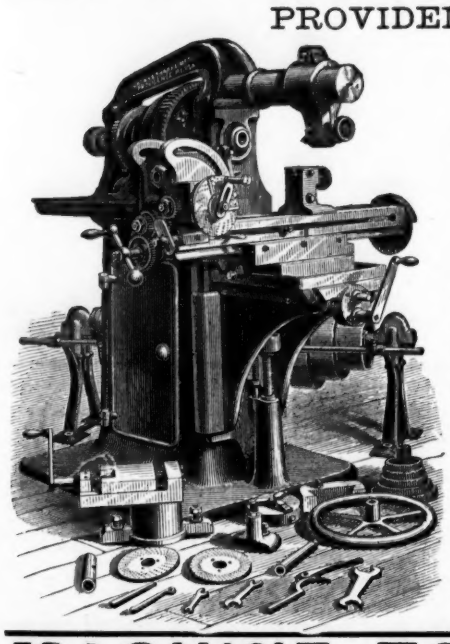
(Jones' Patent, Nov. 6, 1877.)

WM. ALLEN & SONS.
WORCESTER, MASS.

BROWN & SHARPE M'F'G CO.

PROVIDENCE, R. I.

MANUFACTURERS OF THE



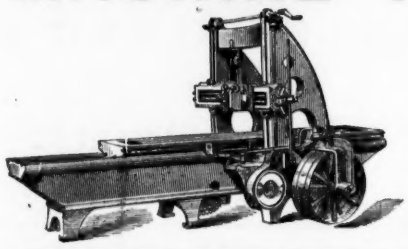
UNIVERSAL Milling Machine

This Machine has been designed especially to meet the wants of Steam Engine and Locomotive builders, and others engaged in the manufacture of heavy machinery and tools.

The essential features and motions are the same as in our smaller Universal Milling Machine, with such enlargement of the whole machine and its parts as would best adapt it for the class of work to be done. The cone has three diameters, each 3½ inches face. In addition, the cone is strongly geared, thus making six changes of speed. There are, also, the same number of changes of feed. The spindle boxes are of hardened cast steel, and, together with the spindle bearings, are carefully ground, and are provided with means of compensation for wear. The spindle will carry a cutter arbor projecting 15 inches, which is supported by an adjustable center at the outer end. Cutters of 8 inches or less diameter can be used. The horizontal movement of the spiral clamp bed upon the knee, in a line with the spindle of the machine, is 6½ inches, and the vertical movement of the spiral bed centers below the spindle centers is 11 inches. The spiral bed can be set at angles of 35° each way from center line of spindle, and can be fed automatically 22 inches, taking also 22 inches between the centers, and will swing 11½ inches.

☞ Illustrated Catalogue sent per mail on application.

MACHINE TOOL WORKS,



FORMERLY

FERRIS & MILES,

Twenty-fourth and Wood Streets

(Take Arch or Vine Street Car),

FRED'K B. MILES, Engineer. PHILADELPHIA

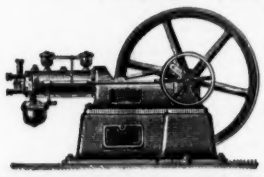
MACHINE TOOLS, STEAM HAMMERS, &c.

Having introduced many novel and valuable improvements into the construction of **SHAPING, SLOTTING, BORING** and **PLANING MACHINES**, as well as **Lathes** and **Drills**, we are now prepared to furnish these machines in greater perfection than ever before. By means of our improved devices the operations of turning, drilling, boring, planing and shaping, or slotting, can all be performed with a great saving of time and labor. It will be found worth any purchaser's while to examine our new methods of screw cutting, feed-gearing and convenient arrangements and attachments for enabling work to be done with the least possible expenditure. We would direct special attention to our new **4 FT. RADIAL DRILL**, with **6 Automatic Feeds, 10 IN. STROKE SHAPING MACHINES, 17 IN. SQUARE PLANING MACHINES** and **PATENT SCREW CUTTING LATHES**, which cut 16 threads and give 16 feeds **without changing gears. Send for Catalogue.**

FRED'K B. MILES.

NEW OTTO SILENT GAS ENGINE.

Working without Boiler, Steam, Coal, Ashes or Attendance.



STARTED INSTANTLY BY A MATCH, IT GIVES FULL POWER IMMEDIATELY.

WHEN STOPPED, ALL EXPENSE CEASES.

No Explosions; No Fires nor Cinders; No Gauges; No Pumps; No Engineer or other attendant while running. Recommended by Insurance Companies.

UNSURPASSED IN EVERY RESPECT for Hoisting in Warehouses, Printing, Ventilating, Running small Shops, etc.

2, 4 and 7 H. P. and upwards. Built by

SCHLEICHER, SCHUMM & CO., 3045 Chestnut St., Philadelphia.

Boston Agency, HILL, CLARKE & CO., 36 & 38 Oliver Street.

STEAM Pumping Machinery

For Feeding Steam Boilers, Filling Reservoirs and Tanks, and for General Pumping.

SEND FOR CATALOGUE

Illustrating every variety of

STEAM PUMPING MACHINERY.

Cope & Maxwell M'f'g Co.

HAMILTON, OHIO.

Machines at reduced prices, and Wheels *Guaranteed*.

LEHIGH VALLEY EMERY WHEEL CO.

Send for our new Illustrated Catalogue

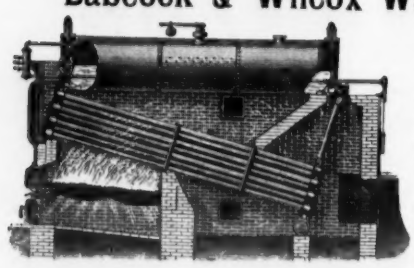
Weissport, Penn.

GEO. W. FIFIELD, manufacturer of **ENGINE LATHES** from 16 to 48 in. swing. Cuts, Photographs and Prices furnished on application. **LOWELL, MASS., U. S. A.**

JAMES W. SEE, Consulting Engineer,

HAMILTON, OHIO.

Babcock & Wilcox Water-Tube Steam Boiler,



Over 40,000 Horse-Power Now in Use. Adapted for all purposes. Safety from Explosions.

In sections easy of transportation. No bolted, screwed or packed joints. All joints made by expanding wrought iron tubes into bored holes. Can be erected or repaired by ordinary mechanic. Easily cleaned from soot or sediment. Adapted to all kinds of fuel. Steady water line and dry steam. No leaks from unequal expansion. Rapid steaming. Highest attainable economy. Centennial Exposition Medal awarded this boiler for highest economy and efficiency on test.

Illustrated Circulars and other desired information promptly furnished.

BABCOCK & WILCOX, Engineers, 30 Cortlandt St., New York.

THE PRATT & WHITNEY CO.

HARTFORD, CONN., U. S. A.

MAKE SPECIALTIES OF

Drop Hammers,

PUNCHING PRESSES,

HAND DRILLING MACHINES, RATCHET DRILLS, COMBINATION LATHE CHUCKS, CUTTERS FOR TEETH OF GEAR WHEELS, SCREW PLATES, HAND, MACHINE NUT AND PIPE TAPS, AND BOLT CUTTERS,

In connection with their business of

MACHINISTS' TOOLS, GUN, SEWING MACHINE and Special Machinery, &c.

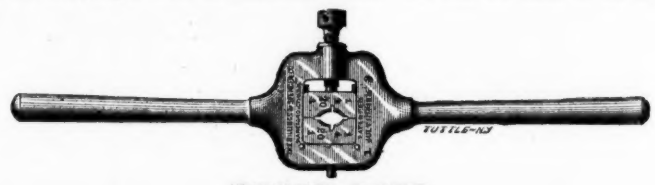
PRICE LISTS FURNISHED ON APPLICATION.

THE BILLINGS & SPENCER CO.

HARTFORD, CT., U. S. A.

Manufacturers of Billings' Patent Screw Plates in Four Sizes.

These Plates are Drop-forged from Siemens-Martin Steel. The Dies are made of the best Tool Ste



PRICE LIST.

No. 0.

With Dies and Tap, Cutting 1-8^{48} 5-32^{40} 3-16^{32} 7-32^{24} 1-4^{20} $5.25

The same, Nickel-plated, in Leather-covered Case, lined with Plush 6.50

Single pair of Dies, each ..... .50

Machinists' or Blacksmiths' Taps furnished to correspond with Dies for Nos. 1, 2 and 3 Plates, at lowest market prices.

No. 1.

With 5 Pairs of Dies, Cutting 1-4^{20} 5-16^{18} 3-8^{16} 7-16^{14} 1-2^{13} $7.00

No. 2.

With 5 Pairs of Dies, Cutting 1-2^{12} 9-16^{12} 5-8^{11} 11-16^{11} 3-4^{10} $10.00

No. 3.

With 5 Pairs of Dies, Cutting 13-16^{10} 7-8^{9} 15-16^{9} 1^{8} 1,1-8^{7} 15.00

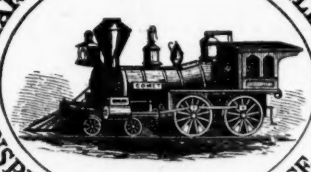
Single Pairs of Dies for No. 1 Plate, $1.00; No. 2 Plate, $1.50; No. 3 Plate, $2.00 each.

Different sizes and number threads furnished.

Special prices quoted on Whitworth or U. S. Standard Threads on application.

Steel and Iron Drop-forgings of every description for Guns, Pistols, Sewing Machines, Machinists' Tools and Machinery generally. Send for Illustrated Catalogue and Price List.

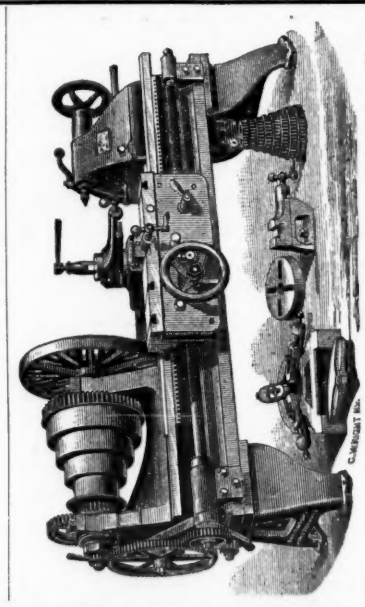
HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.



J. M. ALLEN, PRESIDENT.

W. B. FRANKLIN, VICE-PRESIDENT.

J. B. PIERCE, SECRETARY.

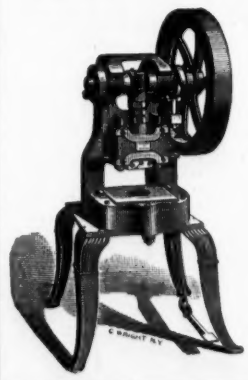


Engine Lathes, Planers, Drills, &c.

DAVID W. POND, WORCESTER, MASS.

Send for Catalogue of New Designs.

GOLD MEDAL AWARDED, PARIS EXPOSITION, 1878.



BLISS & WILLIAMS,

Plymouth, Pearl and John Streets,

BROOKLYN, N. Y.

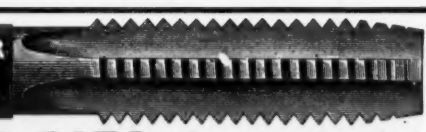
Manufacturers of all kinds of

Presses, Dies and Special Machinery

FOR WORKING SHEET METALS, &c.

FRUIT AND OTHER CAN TOOLS.

J. M. CARPENTER PAWTUCKET, R.I.



Manufacturer of **TAPS AND DIES** of every description.

Also, for sale low, **UNITED STATES STANDARD GAUGES**, from ¼ to 3 inch.